APPLICATION FOR UNITED STATES LETTERS PATENT

TITLE:	METHOD OF TRACKING AND DISPENSING MEDICAL ITEMS
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This application claims benefit pursuant to 35 USC § 119(e) of Provisional Application Serial No. 60/202,508 filed May 5, 2000.

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TECHNICAL FIELD

This invention relates to medical inventory monitoring and dispensing devices and systems. Particularly the exemplary form of this invention relates to apparatus and methods for dispensing and tracking an inventory of medical items used to treat patients in a hospital, clinic or other healthcare setting.

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BACKGROUND ART

The treatment of patients in hospitals and clinics usually involves the receipt by the patient of medical items. These items may include consumable items such as medications. Medical treatment may also involve other disposable items such as dressings and bandages or other medical equipment. Items implanted into the patient or used in conjunction with surgical

15 procedures may also be used and consumed during the course of a patient's medical treatment. Examples of such items include splints, catheters or guide wires which are normally used during cardiac catheterization or angioplasty. To serve the needs of its patients, a clinic or hospital must always maintain sufficient stocks of these items on hand. Further, as medical items are often expensive, the charges associated with their use must be accurately billed to the patient.

In the past systems for tracking inventory and use of medical equipment items in a

hospital or clinic environment have been largely manual systems. The persons responsible for

maintaining an inventory of particular items must monitor the use of the items in each storage

location within the hospital and order additional supplies when it is noted that the available

5   stocks are running low. Often personnel are only familiar with the stocks available in a particular

storage location and as a result, additional stocks may be ordered even though ample supplies are

available elsewhere in the same facility.

Certain drugs used in the course of medical treatment are regulated narcotics. The

receipt, use and disposal of such items is required to be monitored and tracked. Supplies of such

10   drugs must be kept in secure locations. Certain items may be dispensed from the secure storage

only by two (2) authorized users accessing the material and certifying the manner in which it is

used. The handling use of such narcotics also may require considerable paperwork which takes

valuable time.

The recording of medical items so that the patient may be billed for their use in the course

15   of treatment in the past has also been largely a manual operation. The fact of use by the patient

must be recorded in the patient's chart. In some cases items have peel-off labels that include a

bar code that can be scanned and used for billing purposes. However, this still requires that the

nurse or medical technician transfer the correct coding to the proper location for later billing.

Complications in billing become even greater when items are removed from inventory to

20   accomplish a planned procedure and then the items are not used. A patient may be charged for

use of a particular item which is removed from inventory in anticipation of the procedure. If

2

during the procedure the item is not needed, a corresponding credit must be issued when the item

is returned to stock. All of these activities take time away from persons who could otherwise

devote their time to the treatment of patients. Such tracking and billing practices are also prone

to inaccuracies which may cause the hospital or clinic to lose money or which may result in

5   overbilling of the patient.

Thus there exists a need for an apparatus and system for monitoring and dispensing

medical items in hospital or clinic environments that can more accurately monitor inventories,

dispense medical items and correlate the use of medical items with the patient whose treatment

has included their use. There further exists a need for a method and system for the restocking of

10   medical items in such a system that provides more accurate, convenient and secure movement of

medical items from a pharmacy or other location where medical items are prepared, to the

locations where the medical items are taken for use by patients. There further exists a need for

tracking the location and/or use of medical items in a pharmacy.

DISCLOSURE OF INVENTION

15   It is an object of an exemplary form of the present invention to provide a system for

monitoring an inventory of medical use items to provide an indication of what items have been

used.

It is a further object of an exemplary form of the present invention to provide a system for

monitoring the use of medical use items so that supplies may be replenished before depletion.

20   It is a further object of an exemplary form of the present invention to provide a system for

monitoring an inventory of medical use items that monitors a plurality of items in real time.

3

It is a further object of an exemplary form of the present invention to provide a system for monitoring an inventory of medical use items that minimizes the processing of paper forms.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medical use items that indicates the patient whose treatment has involved the medical use items.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medical use items that can be used to indicate the technician or physician who has used such medical use items.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medical use items that provides for crediting of a patient's account upon return of an unused item to inventory.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medical use items that is used to store and dispense restricted items in a secure manner.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medical use items that are stored in a refrigerator or other compartments having controlled environmental conditions.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medical use items that can guide a user to select the items that will be used in a particular medical procedure.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medical use items that may be used to track and dispense a wide variety of various items and to record their use in a clinical or hospital environment.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medical use items that enables a user in the course of a dispensing sequence to selectively review and dispense medications by either the generic name or the brand name.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medications that enables a user to dispense together predetermined medical items that are used as a kit in the conduct of a medical procedure.

It is a further object of an exemplary form of the present invention to provide a dispensing mechanism that reliably dispenses medicines to a user in response to the user's selection of items.

It is a further object of an exemplary form of the present invention to provide a system for tracking, receipt, use, transfer or disposal of medical items within a facility.

It is a further object of an exemplary form of the present invention to provide a method for monitoring and dispensing medical use items.

It is a further object of an exemplary form of the present invention to provide a method for monitoring an inventory of medical use items that are not tracked to a patient.

It is a further object of an exemplary form of the present invention to provide a method and system which can track the administration of medical items to patients.

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It is a further object of an exemplary form of the present invention to provide a method for dispensing medical items and assessing appropriate charges for medical items dispensed.

It is a further object of an exemplary form of the present invention to provide a method for dispensing medical use items that can be carried out more rapidly and efficiently.

It is a further object of an exemplary form of the present invention to provide a method for more efficiently restocking storage locations with medical use items.

It is a further object of an exemplary form of the present invention to provide a method for restocking storage locations with medical use items that provides enhanced security.

It is a further object of an exemplary form of the present invention to provide a method for restocking storage locations with medical use items that reduces errors in the restocking of storage locations.

It is a further object of an exemplary form of the present invention to provide a method for restocking storage locations with medical use items that employs removable liners in a storage location which liners can be transported between a stocking location and a storage location from which medical use items are taken for patients and which subsequently can be removed from storage locations and returned to the stocking location.

It is a further object of an exemplary form of the present invention to provide a method for restocking storage locations with medical use items that includes a liner configuration that can be handled more efficiently during transport.

It is a further object of an exemplary form of the present invention to provide a method for restocking storage locations with medical use items that provides a tamper indicating container for transporting the medical use items.

It is a further object of an exemplary form of the present invention to provide a method for monitoring and dispensing medical use items stored in a refrigerator or other environmentally controlled storage area.

It is a further object of an exemplary form of the present invention to provide a system for monitoring and dispensing medical use items that enables monitoring and dispensing of medications when portions of the system are not operational.

It is a further object of an exemplary form of the present invention to provide a method for operating a system for monitoring and dispensing medical use items that selectively updates stored information to maximize accuracy.

It is a further object of an exemplary form of the present invention to provide a method for tracking, receiving, using, transferring or disposing of medical items within a facility, or a particular area with a facility such as a pharmacy.

Further objects of exemplary forms of the present invention will be made apparent in the following Best Modes for Carrying Out Invention and the appended claims.

The foregoing objects are accomplished in exemplary embodiments of the invention by a system for monitoring and dispensing medical items in an environment where patients are provided medical treatment such as a clinical or hospital environment. The system includes a plurality of item storage locations. A particular type of medical item may be stored in each

location. For example, one type of medical item may include a particular type of catheter. Another may be a particular type of medication packaged in a particular dosage. Each location in the system includes at least one unit of the particular type of medical item.

In an exemplary embodiment a sensor is positioned adjacent to certain storage locations. The sensor is particularly adapted to sense the addition or subtraction of a unit of the particular type of medical item that is stored in the location. As a result, each time a unit of the particular item is added or removed from storage in the location, the sensor senses this and generates a signal.

A counter is connected to each such sensor and records the number of units added or removed from each location. The counter holds a count of the change in the number of units at the location since the last time the counter was read.

The counters associated with each location are connected to at least one processor and at least one memory or data store. The data store includes a total of the number of items that are located in storage at the location. Periodically, the processor communicates with each of the counters and reads the change in the number of units stored therein. Thereafter the processor is operative to update the total number stored in the memory to reflect the number of items currently stored at the location.

Embodiments of the invention may include a data terminal which includes a user interface and which terminal is connected to the processing system and the counters. The data store may include records concerning one or more types of information such as information regarding patients, procedures, authorized users of the system and each of the products stored in

8

each of the locations, including pricing information. The data store may further include data

representative of medical items prescribed for patients as well as the medical items that have

been taken by users of the system for patients. The data store may further include data

representative of the functions a system user usually performs and the activities the user has

5   performed. The data store may further include data representative of whether each particular

medical type item is tracked to patients, whether each type of medical item is billed to patients,

and the quantity or level of medical items stored in each storage location. The data store may

further also include information concerning medical items used in the treatment of each patient

and when such items were used or given to the patient.

10   The data store may also include data in correlated relation concerning the brand names

and generic names for medications and other medical items stored in the locations of the system.

The data store may also include information on "kits" which are groups of medical items that are

used together. Such kits may be groups of items which are used together repeatedly, such as in

doing a diagnostic test. Alternatively, a kit may comprise items that are to be used on a one-time

15   basis, such as for a particular patient's operative procedure. The data on items in each kit are

stored in correlated relation with the kit designation in the database.

A system user, such as a technician or nurse, may use the interface of the data terminal to

identify the particular patient who is to receive the medical items taken by the user. Upon

removal or dispense of the items from the storage locations, the use of such items is recorded in

20   correlated relation with the patient record in the data store so that the patient's chart may be

automatically updated and the item charged. Alternatively the taking of the medications by the

9

user may be stored in the data store and a later input may be provided to the system to indicate that the medical item has been given to the patient which information is also recorded in the data store. In addition, a user using the data terminal may review information in the data store concerning procedures and physicians to determine what medical items are required by a

5   physician to conduct a procedure and may remove such items for delivery to an operating room. This information may include kits which relate to particular procedures. The user is enabled to take or cause medical items to be dispensed through inputs to the data terminal.

The user may also use the interface of the data terminal to check stocks of medications which are available as well as medications which have been prescribed for a patient. The user is

10   enabled to use the interface to check the brand name for medical items designated by generic name, and vice versa. This is done by the user interface interfacing with the drug information stored in the data store. This enables a user to check for the availability of medications by either brand or generic name. This also enables a user to check the appropriate character of an item prescribed by checking its other name. This also enables a user to determine the availability and

15   use a brand name or generic name equivalent to the medical item prescribed, when the brand or generic type prescribed is not available.

In some embodiments of the invention, controlled substances such as narcotics, may be dispensed using the system from a dispenser mechanism or an electronic lock drawer. In some embodiments, the user is required to identify himself at the display terminal. This information is

20   processed and compared to authorized user records in the data store to verify that the user is an authorized user. In some embodiments the identifying information on the user may be placed on

an encoded object or article such as a card, and the user may be assigned a personal identification

number (PIN) that is memorized by the user. The data terminal preferably includes a reader for

reading the coded object and for receiving the user's PIN number which has a predetermined

relationship to the data on the encoded object. The proper input of the PIN with the

5   corresponding user's coded object verifies that a proper user is requesting to gain access to the

items. For some strictly controlled substances two (2) authorized users may be required to input

their coded objects and PIN numbers in order to gain access to the controlled items. In

alternative embodiments biometric type identification devices may be used, such as those that

identify a user by fingerprints, hand scans, retina scans, iris scans, voice prints or other body

10   features.

In some embodiments medical items may be stored in an interior area of a refrigerator.

The refrigerator may be of a conventional or unconventional type having a door for accessing the

interior area. The refrigerator may preferably be fitted with a lock module which enables

selectively enabling access to the interior area in response to signals from the display terminal.

15   In exemplary embodiments the lock module may be readily attached to exterior surfaces of the

refrigerator. A lock module enables the refrigerator to operate in a manner similar to an

electronic lock drawer. Varying levels of security for refrigerated items may be provided by

using several refrigerators each of which includes its own lock module. Alternatively

subcompartments within the refrigerator, each with individual lock modules, may be provided.

20   Other types of environmentally controlled storage and dispensing devices may be provided as

well.

11

In some embodiments of the invention, once the authorized user has provided the necessary identification, the processor may operate to cause the desired substance to be dispensed or made accessible to the user. The user is also required to input the corresponding patient data so that the patient's chart and billing may be updated.

5   In some alternative embodiments a user is enabled to access the system using a scanner or similar reading device. Instead of inputting data into the display terminal to identify himself, the user scans a machine readable code on a badge, identification card or other article or body feature corresponding to the user. For the dispensing of narcotics, which may require two authorized users, two users may scan their respective identification item using the reading device. The

10   reading device preferably includes an output device, such as a small screen, which provides messages to prompt users on the steps to be taken in a manner similar to that done when the user operates a display terminal. The reading device also preferably has an input device thereon, such as an alphanumeric keypad and/or function keys, which provides additional ways for a user to provide inputs to the reading device in addition to scanning machine readable indicia.

15   In some alternative embodiments, storage locations such as shelves, drawers and/or refrigerator units preferably have machine readable indicia adjacent thereto. The machine readable indicia corresponds to the location designator for the storage location, and the data stored in the data store includes data representative of the type of medical item stored in each location. The storage locations may also include a further machine readable indicia thereon

20   which is indicative that the quantity of medical items in the storage location is depleted. The further indicia is preferably positioned in or adjacent to the storage location so as to be accessible

12

by the reading device when the last of the medical items in the storage location has been removed.

Some alternative embodiments including the reading device are useful for indicating various types of quantity conditions which occur at storage locations. An exemplary form of the reading device includes a processor and a local data store therein which enables it to perform operations in accordance with its programming, which is referred to herein as its configuration. The reading device also produces transaction messages which are sent to other components of the system.

Certain types of medical items are not tracked or billed to patients. Such items may include aspirin, cotton swabs or bandages. Items of this type may be stored in an open storage location such as open shelving and are available for any user to take. The storage locations for items that are not tracked to patients are preferably marked with machine readable indicia of a type that is visibly distinguishable to a user from indicia for storage locations holding items that must be tracked and billed to patients. The storage locations for items that are not tracked to patients are preferably marked to show a desired level or quantity (a "par value") of medical items that should be kept in the storage location. If the level of medical items in the location drops and a user observes that it is below par value, the user may scan the indicia with the reading device. The reading device is preferably configured to treat the scanning of indicia corresponding to a storage location, absent previously inputting data related to a user or a patient, as indicative of a quantity condition at the location which corresponds to the storage location being below par value.

13

Alternatively, when all the medical items have been removed from the storage location the user may operate the reading device to read the further indicia adjacent the storage location representative of the condition that all the medical items in the location have been depleted. Such a condition is an alternative quantity condition which causes different signals to be generated by the system from those corresponding to the first quantity condition. Transaction messages comprised of signals are produced by the reading device corresponding to the different quantity conditions. These transaction messages are sent to other components of the system, and in the case of messages which indicate that a storage location is below par value or depleted, are responded to by restocking the storage location with an additional quantity of medical items.

In some alternative embodiments the reading device can be used for tracking medical items taken for use by patients. A user may log into the system using the display terminal or by using the reading device to read their identification card, badge, other identifying article or feature. Most users of the system who are nurses or medical technicians perform activities which are primarily the dispense of medications for use by patients. The data store may include data representative of the dispense function as the function associated with such users. The user will be considered by the system as performing this function unless the user provides an input to the reading device that indicates that he or she is going to perform a different function.

In some forms of the system once the user has logged onto the system, he or she may select a patient at the display terminal and may scan or read the indicia at the locations from which medications are taken for the patient. This will cause the information concerning the taking of the medications for the patient to be stored in the data store. If access to the desired

14

medication or medical item is controlled by an access control device, such as an electrical lock on a cabinet, a lock module on a refrigerator, or an electronic lock drawer, the reader can be used to gain access to the medical items controlled by the access control device. The storage location or locations to which access is controlled by the access control device preferably includes

5   machine readable indicia on its exterior. In operation of the described form of the system, when an authorized user is logged on the system, scanning the indicia associated with the access control device enables the user to access the medical items, such as by unlocking a lock or opening a drawer. The indicia corresponding to the locations from which the medical items are taken may then be read with the reading device. A transaction message is generated which is

10   used to update the information in the data store. The transaction message preferably updates the data concerning medications taken for the patient, as well as the inventory status for medical items at the various storage locations from which the items have been removed. The user can then select another patient at the display terminal and repeat the process.

          The system of some alternative embodiments also have available in the data store not

15   only data representative of the patients who may receive medical items but also the medical items that have been prescribed for use by such patients. This enables printing reports with a report generating device. Such reports may include both human readable as well as machine readable indicia representative of patients and their prescribed medications. In some alternative forms of the invention a user may use the reading device to select a patient by reading the indicia

20   corresponding to that patient from a report rather than selecting the patient using the display terminal. The user may then scan the indicia from the storage locations to indicate the medical

15

items taken for the patient in the manner previously described. Alternatively, the indicia

corresponding to a medical item may be scanned from the report if access to such medical item is

controlled by an access control device. For example, if the item is stored in the interior of an

electronic lock drawer, refrigerator or a dispenser, scanning the indicia on the report causes the

5   system to operate to make the item accessible to the user by opening the access control device to

the storage location or by causing the item to be dispensed from the dispenser.

A user may select several patients and their associated medical items in a sequence using

the indicia on a report. The reading device preferably holds the information until the user

indicates that they are done by "logging off" the system. This avoids slowing the system

10   operation by trying to send messages to other components of the system while the user is

operating the reading device. After the user has logged off, the transaction messages may be sent

as a batch to the other components of the system. A user may log off the system by inputting a

command through the input device such as the keypad on the reading device. Alternatively, a

user may log off by scanning machine readable indicia which indicates that the user is logging off

15   the system, or by a new user scanning indicia associated with the new user. Alternatively, or in

addition, the reading device may be provided with a storage location referred to herein as a

cradle, and a log off signal may be generated whenever the reading device is returned to its

cradle. Of course in alternative forms of the system the reading device may send its transaction

messages as events are occurring rather than waiting until after a user logs off.

20   The reading device may in various embodiments be connected to the remainder of the

system by a data line or may communicate its messages through forms of wireless

16

communication. Dispensers, drawers and other types of storage locations which incorporate

access control devices in the described embodiment are connected to the system by data lines.

However in alternative forms of the system such devices may be connected to the remainder of

the system through wireless communication methods. Such dispensing devices may in some

5   embodiments include a processor and a memory which enables them to operate in an off-line

mode of operation. Such devices may then communicate with the rest of the system to

periodically deliver information on dispensing or restocking activities. This communication may

be accomplished by data line, wireless communication methods or through an intermediate

device which can receive data from the dispensers, store the received data, and deliver it to the

10   rest of the system. The intermediate device may have various portable or stationary forms, and in

certain embodiments may be the reading device or a device functionally similar thereto.

In some exemplary embodiments of the invention medical items may be tracked as

dispensed for a patient by a user and then further tracked through the giving of the medical item

to the patient. For purposes of this description "giving" a medical item to a patient refers to any

15   use of a medical item for the benefit of a patient. In such exemplary embodiments data is stored

indicating that the particular medical item has been given to the patient. This may be

accomplished in exemplary embodiments through inputs to a portable terminal which is carried

by a nurse to the bedside of the patient. Data representative of giving particular medical items to

the patient may be stored in the portable terminal by providing inputs. These may include

20   manual inputs or inputs achieved by reading machine readable indicia with a reading device. The

machine readable indicia may include indicia on reports indicating what has been prescribed for

the patient, and/or indicia on a patient associated item such as a label on a bed, badge, chart or wristband. The data recorded in the portable terminal may be communicated to other components of the system, such as by wireless communications or through a physical connection. The data concerning the giving of the medical items is then stored in the data store in correlated

5   relation with the information concerning the respective patients.

Some alternative exemplary embodiments include systems in which patients may dispense medical items directly from self service dispensers. In such embodiments the patient is enabled to gain access only to their own prescription information. The patient is enabled to select the prescribed items and have them dispensed. In situations where the patient is required

10   to make payment for the dispensed items at the time of delivery, payment may be made via credit or debit card. Computers connected in exemplary embodiments of the system may be operative to determine from stored data, the insurance benefit plan and rules of the plan associated with the patient. This enables the patient's benefits provider to be invoiced for any covered amount and the patient's account to be charged only for any co-pay amount. Additional features are provided

15   in connection with such aspects of the system to increase the probability that the patient properly receives their prescribed medications.

Some embodiments of the invention may use a reading device for reading machine readable indicia which is used to facilitate restocking of items in the system. Labels may be provided on storage locations to indicate a restocked condition. Alternatively, or in addition,

20   reports can be generated based on the data in the data store which shows the storage locations which require restocking with additional items. Such reports may include human as well as

18

machine readable indicia showing the item to be restocked, the storage location, the number of

units to be added, as well as an indication that a restock function is to be performed. Users who

primarily perform restocking functions may be provided identification cards, badges or other

associated articles or features with machine readable indicia that identifies them, and the data

5   store includes data which indicates that the activity normally carried out by such users will be a

restock function unless otherwise specifically indicated.

Users who restock storage locations may identify themselves to the system using the

display terminal, or alternatively by reading the indicia from their identification card, badge,

article or feature with the reading device. Such users may indicate that storage locations have

10   been restocked by scanning the machine readable indicia for a location from a report or from the

storage locations, or both, in accordance with the configuration of the reading device. Numerical

data concerning the number of items in inventory can be counted and input through the keypad

on the reading device. The reading device is also preferably configured to provide prompt

messages on a screen or other output device, to guide a user through the restocking process.

15   In some embodiments of the invention the dispensing and restocking processes may also

be accomplished through the interface of the display terminal, as well as by using the reading

device. This enables users of the system to accomplish their functions using either the display

terminal or the reading device, and in the event one malfunctions, required activities can still be

carried out. This ability to carry out functions through the reading device, the display terminal,

20   or both working cooperatively increases flexibility and reliability of system operation.

19

In some forms of the system dispenser devices such as electronic lock drawers, refrigerators, cabinets and other types of dispensers may accept removable liners in the storage locations therein. The liners may hold the type of medical item that is dispensed from the storage location and may be configured to enable removal of medical items from the liner either

5   manually or mechanically in accordance with the normal operation of the dispenser device. Open storage locations for medical items may also include removable liners in the open storage locations.

The use of the removable liners may be used to facilitate restocking the storage locations. For example, each liner may be stocked with a first type of medical item in a stocking location

10   such as in a pharmacy. Once the liner has been filled, a removable lid may be installed to restrict access to the medical items held in the liner. Preferably a locking mechanism such as a tamper indicating lock is used to hold the lid in engagement with the liner.

In some embodiments machine readable indicia is applied to each liner. The machine readable indicia includes information representative of the storage location in which the liner is

15   to be installed. This indicia may include data representative of a particular storage location. Alternatively the indicia may include only the type of medical item housed in the liner. The location in which the liner will be installed may then later be determined based on information stored in the data store. The indicia applied in associated relation with the liner may be in the form of a bar code label applied to the liner or the lid. Alternatively the indicia may be applied in

20   connection with a tamper indicating seal which is part of the locking mechanism which holds the lid and the liner together.

In some forms of the invention the indicia which is applied in associated relation with the liners comprises a bar code. The bar code is preferably produced using a printer in the restocking location. The bar code indicia is preferably in the form of labels that may be transferred to the liners or tamper indicating tags associated therewith. A restock report may also be produced at

5   the stocking location to indicate where the liners or the type medical item held therein are to be installed. This information is produced based on information stored in the data store which indicates where restocking is required.

In some forms of the invention the liners and lids are configured to be stacked in nested relation. One exemplary configuration provides for releasible engagement which restricts

10   shifting of the liners as they are transported from the restocking location to the storage locations in which the liners are installed.

Once the filled liners reach the area adjacent to the dispenser device or other location in which they are to be installed, the restocking user accesses an interior area of the dispenser device, cabinet, refrigerator or other storage location. This is done by the restocking user in the

15   established manner for the system. This may include the restocking user logging onto an appropriate device such as a data terminal or scanning device, which is done using indicia identifying the user.

In some exemplary methods of operation of the system a restocking user may access storage locations by reading the machine readable indicia associated with the liner. Upon reading

20   the indicia, information stored in the data store is used to determine the location corresponding to the indicia. For example if the indicia indicates the type of medical item in the liner, the stored data is used to determine the storage location in which that particular type medical item is stored

21

in that particular dispensing area. The information in the data store may then be used by the computer to provide the restocking user with access to that particular location. This may be done such as by unlocking the drawer in an electronic drawer module where that particular type of medical item is stored. In alternative embodiments a user may gain access by scanning

5   information off of the restock report which indicates where the liners are to be installed. In further alternative embodiments other approaches may be used.

Once a restocker has gained access to the storage location where the liner is to be installed, the user generally must remove a previously installed liner from the storage location. This previously installed liner may contain medical items. The user unlocks the locking device

10   for the liner that is to be installed and removes the lid therefrom. This may be done either before or after the liner is installed in the storage location depending on the particular situation.

In some embodiments the restocking user may transfer medical items from the previously installed liner to the new liner. When this is done information concerning the number and type of units transferred is input to the system through an input device such as the display terminal or

15   a scanner. Alternatively the previously installed liner may be secured with the lid from the liner that has now been installed in the storage location. If the previously installed liner includes medical items that are to be returned to the stocking location, the lid is preferably secured to the liner with a locking device such as a tamper indicating seal. The previously installed liners are then preferably returned to the stocking location. If medical items were returned with the

20   previously installed liners, the type and number thereof is checked against the data stored in the data store to verify that no improper activity has occurred.

22

In some exemplary embodiments of the invention proper installation of the new liners in the storage locations may also be verified electronically. This may be accomplished by labeling the storage locations with identifying indicia. This indicia may be representative of the location or alternatively may include the type of medical item that is stored therein. To verify that the

5   liners are properly installed once access to the storage location has been obtained, a restocking user reads the location identifying indicia from the location with a scanner. A computer then determines based on the information stored in the data store whether the location in which the restocking user is installing the liner is a proper location for the liner to be installed. If a possible error is detected, an appropriate signal is given so that the user is alerted that they may be

10   installing the liner improperly. This feature may be particularly valuable when liners are being installed in cabinets or refrigerator units where access to several storage locations is controlled by a single locking mechanism. Likewise this feature is useful when liners are being installed in open storage locations.

In some embodiments of the invention, the system may interface with other computer

15   systems such as the admission-discharge-transfer (ADT) computer system that the hospital uses to track patients. This is a computer system which may be used in a hospital, clinic or throughout other types of facilities or groups of facilities to track patient location and activity. In addition, some systems of the present invention may also be connected to the hospital information system (HIS) which is the record storage facility of the hospital or other organization

20   which maintains computerized records concerning patients. The system may be interfaced to the pharmacy system which keeps records of medications prescribed for each patient. Some embodiments of the system may also provide tracking of activity within the pharmacy. As a

23

result, patient activity, record keeping, and billing may be automated through the system of the present invention, along with inventory monitoring. Systems of the invention may also interface with or incorporate other networks and systems including databases and financial transaction systems for obtaining information and carrying out financial transactions associated with patient

5   treatment activities. Embodiments of the present invention may also be used to produce a wide variety of reports from the data store related to patients, authorized users, physicians and various types of items used in inventory. Such a system may also be integrated with an automatic ordering system so as to transfer supplies from one location to another where they are needed and/or to automatically place orders for additional supplies with vendors when supply levels

10   reach a limit.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a side cross sectional view of an inventory monitoring apparatus called a hook register used in an exemplary system of the present invention.

Figure 2 is a front cross sectional view of the hook register shown in Figure 1.

15   Figure 3 is similar to Figure 1 depicting a medical item being removed from the hook register.

Figure 4 is a partial cut-away top plan view of a further inventory monitoring apparatus of an exemplary embodiment of the present invention called a box register.

Figure 5 is a side elevation view of the box register shown in Figure 4 as seen along line

20   v-v of Figure 4.

Figure 6 is an enlarged view of the circled portion VI shown in Figure 5.

24

Figure 7 is a side view of a lever used in the box register shown in Figures 4 and 5.

Figure 8 is a top plan view of the lever shown in Figure 7.

Figure 9 is a front view of an alternative box register.

Figure 10 is a partial side view of the box register along line 10-10 in Figure 9.

Figure 11 is an enlarged side view of a switch and lever of the box register shown in Figure 9.

Figure 12 is a front, partial cut-away view of the lever and switch of the box register shown in Figure 9.

Figure 13 is a schematic view of the system for monitoring and dispensing medical items including the hook registers and box registers.

Figure 14 is a top plan view of a dispenser mechanism for vials containing medications.

Figure 15 is a cut-away side view of the dispenser shown in Figure 14 with the gate members thereof in a first position.

Figure 16 is a view similar to Figure 15 with the gate members of the dispenser in a second position.

Figure 17 is a side view similar to Figure 16 with the gate members in a third position wherein a vial is dispensed from the mechanism.

Figure 18 is a cross sectional view corresponding to the dispenser as shown in Figure 15.

Figure 19 is a side view of the dispenser mechanism corresponding to Figure 16.

Figure 20 is a side view of the dispenser mechanism corresponding to Figure 17.

Figure 21 is a side view of the dispenser mechanism and gate members in the positions shown in Figure 15.

Figure 22 is a side view corresponding to Figure 21 including hidden edge lines.

Figure 23 is a side view of the dispenser mechanism with the gate members in the positions shown in Figure 16.

Figure 24 is a side view of the dispenser mechanism corresponding to Figure 23 including hidden edge lines.

Figure 25 is a side view of the dispenser mechanism with the gate members in the positions shown in Figure 17.

Figure 26 is a side view of the dispenser mechanism corresponding to Figure 25 including hidden edge lines.

Figure 27 is a sectional side view of the dispenser mechanism shown in Figure 14 located inside a medicine dispenser.

Figures 28 through 39 are windows displayed on the touch screen of the data terminal in an embodiment of the invention, with Figure 28 being a patient browser window.

Figure 29 is a patient information window.

Figure 30 is a patient usage browser window.

Figure 31 is a med order browser window.

Figure 32 is a supply browser window.

Figure 33 is a kit browser window.

Figure 34 is a kit information window.

Figure 35 is a supply browser window selected to display trade name information for the displayed medical items.

Figure 36 is a supply browser window like Figure 35 selected to display generic name information for the displayed medical items.

Figure 37 is a physician/route/site browser window selected to display route information for a medication.

Figure 38 is a window through which a user may log into a display terminal.

Figure 39 is a non-itemized supply inventory window which is used to review and input information concerning non-itemized medical items which are not tracked to patients.

Figure 40 is a schematic view of an alternative embodiment of the system for monitoring and dispensing medical items.

Figure 41 is a label with machine readable indicia for identifying a storage location.

Figure 42 is a label with machine readable indicia for indicating an out of stock condition at a storage location.

Figure 43 is a label with machine readable indicia for indicating that a storage location has been restocked.

Figure 44 is a label with machine readable indicia to indicate that the quantity of items in a storage location is below a desired level.

Figure 45 is a schematic view representative of placement of labels similar to those shown in Figures 41 and 42 adjacent a storage location for a medical item.

Figure 46 is a view of machine readable indicia which may be included in a restock report.

Figures 47-49 are a logic flow diagram showing steps that are carried out in the reading device of the alternative embodiment of the system shown in Figure 40.

Figure 50 is an isometric view of a refrigerator which holds medical items in an interior area, the refrigerator having a lock module mounted thereon.

Figure 51 is a front view of the lock module and bolt supporting bracket shown in Figure 50.

Figure 52 is a partially sectioned view of the lock module.

Figure 53 is a partially sectioned top view of the bolt supporting bracket.

Figure 54 is a sectional side view of the lock module and bolt supporting bracket with the bolt shown in engaged relation with the lock module.

Figure 55 is a schematic view of a system of the present invention which may be used to perform a restocking method for storage locations which includes removable liners.

Figure 56 is an isometric view of an embodiment of a removable liner and lid.

Figure 57 is a side cross sectional view of a drawer in an electronic lock drawer module, shown in an extended position shown with a removable liner installed therein.

Figure 58 is a transverse cross sectional view of a removable liner and a divider installed in the removable liner.

Figure 59 is a side view of a first end of a liner and an engaged lid including the engaged hinge parts thereof.

Figure 60 is a side view of a pair of liners and lids shown in stacked relation.

Figure 61 is a top plan view of a lid with a portion of an overlying liner shown thereon in phantom.

Figure 62 is a schematic view of an alternative form of a system of the invention similar to that shown in Figure 40 which includes additional features for tracking the giving of medical items to patients.

Figure 63 is a schematic view of an alternative form of a system of the invention similar to that shown in Figure 40 which includes additional features for giving medical items to patients through self service dispensers.

Figures 64-67 are a flow chart schematically representing logic flow utilized in connection with the operation of the system represented in Figure 63.

Figure 68 is a schematic view of an alternative form of a system of the invention similar to that shown in Figure 40 which includes additional features for tracking medical items within a pharmacy and for tracking the dispensing of items from supply cabinets.

Figures 69-96 are exemplary screen outputs provided in exemplary embodiments through the use of pharmacy software used for tracking medications to and from a pharmacy operated in connection with a facility.

Figures 97-107 and 109-115 are exemplary screen outputs provided in further exemplary embodiments through the use of pharmacy software used for tracking medications to and from a pharmacy operated in connection with a facility.

Figure 108 shows a table of original events and corresponding linked events which are tracked with exemplary embodiments through the use of pharmacy software used for tracking medications to and from a pharmacy operated in connection with a facility.

BEST MODES FOR CARRYING OUT INVENTION

Referring now to the drawings and particularly to Figures 1 and 2, there is shown therein a first embodiment of an inventory monitoring apparatus for use in an exemplary form of the present invention referred to as a hook register and generally designated by reference numeral 10.

5 Apparatus 10 includes an elongated housing 12 including an upper wall 14, a lower wall 16, side walls 18 and 20, a front wall 22 and a rear wall 24. Housing 12 may be formed of any suitable durable material such as plastic or metal. A clip assembly 26 or similar attachment mechanism is desirably carried by a flange 28 of rear wall 24 whereby the housing may be detachably fastened to a rail or similar support structure 30 affixed to a wall 32 or like surface. As will be discussed

10 in greater detail hereafter, rail 30 may also carry a communications bus 34 or other suitable means for electrically connecting the apparatus 10 to a similar apparatus and to a remote computer and data terminal.

An object support means is designated by reference numeral 36. As illustrated, the object support may assume the form of an elongated rigid or angled rod which may be suitably formed

15 of metal or plastic. A shorter leg 38 of the object support means is affixed such as by threaded fasteners 40 to the rear wall 24 of housing 12. A longer leg 42 of the object support means extends generally longitudinally of the housing 12 and is capable of supporting a plurality of objects 44. Thus, according to the first embodiment, object support means 36 resembles an elongated peg or rod which suspends objects 44 from holes or perforations 46 provided therein

20 (see Figure 2). The longer leg 42 of support means 36 also desirably is formed with a raised portion 42A to prevent the objects from unintentionally sliding off the object support means.

It will be appreciated that hook register 10 finds beneficial usage with articles or objects which are suitable for suspension and whose inventory it is desirable to monitor. Typical items may include packages containing medical items such as drugs, medical equipment and supplies, including for example, catheters and guide wires for angioplasty or other medical items which should be strictly and accurately monitored because of theft, safety, critical need or other concerns. For this reason, the object support means may assume any form necessary or desirable to support the objects supported thereby. That is, the object support means may be configured as a rack, multiple hooks or pegs or similar cantilevered members, a tee bar or other such equivalent constructions.

A switch actuating means 48 desirably configured as a pivotable lever is mounted generally at its midpoint to housing 12 by a pivot pin 50. In the preferred embodiment, a first end of lever 48 projects through an opening 52 in lower housing wall 16. It is also contemplated that lever 48 may be adapted to project through an opening similar to opening 52 and may be provided in any other wall of housing 12 so long as those components necessary for the proper functioning of the apparatus 10 are correspondingly repositioned to accommodate the desired orientation and operation of lever.

A second end of lever 48 is connected to suitable biasing means 54 which in the preferred embodiment is a spring. In the preferred embodiment, the biasing means is a tension spring, however in other embodiments biasing means such as torsion springs, compression springs, elastomeric means or the like may be used. The biasing means normally biases the lever to an "inoperative" position in which the lever extends generally transverse to the longer leg 42 of the object support means 36 of the hook register as depicted in Figure 1.

31

It is important that the first end of lever 48 sufficiently project from housing 12 whereby it may be contacted and displaced by a medical item 44 which may be either added to or removed from the object support means. To assure that the lever will interfere with the passage of an object, either into or out of a location on the object support means, a first end of lever 48 is

5 provided with a notch 56. Notch 56 is configured to receive the longer leg 42 of the object support means 36 therein. As a result, when a medical item is removed from its storage location on the object support means, the object contacts and then displaces the lever so as to rotate it outward. The object then passes the lever and once this occurs the biasing means 54 returns the lever to the inoperative position.

10 A printed circuit board 58 is mounted in the interior of housing 12. Apart from certain circuitry components specifically identified below which are essential to provide an adequate appreciation of the operation of the hook register, it will be understood that circuit board 58 includes printed circuitry and other circuitry components.

Electrical switch means are supported by and electrically connected to the circuit board

15 58. During operation the switch means serve as part of a sensor that generates signals indicative of the placement of objects into the storage location on object support means 36 or removal of such objects from the storage location. The preferred embodiment of the hook register utilizes a pair of switch elements 60 and 62 as the electrical switch means. In the preferred embodiment, the switch elements are Hall-effect sensors which change states (off-to-on) when a magnetic field

20 is detected within close proximity. Lever 48 carries a compact permanent magnet 64 which serves as an actuator means. The magnetic field produced by magnet 64 is capable of being sensed by switches 60 and 62 to affect changes in their status. The signals indicating changes in

32

the status of the switches are detected by a signal processing circuit 65 which converts the signals to an appropriate form to be received and counted by a microprocessor 66. The microprocessor 66 in the hook register serves as a counter which stores a count therein as later described.

Operation of the hook register 10 is graphically represented in Figure 3. Specifically, the object 44, which is preferably a medical item, is shown at the instant in time when it has fully deflected the lever 48 against the force of the biasing means 54 and has just passed the first end of the lever. At this moment, the permanent magnet 64 is pivoted into a substantially facing relationship with magnetic field detector switch 60. Switch 60 is triggered upon detection of the magnetic field in proximity to the switch element and generates a signal indicating that one object unit has been removed from the object support means 36. Once the medical item has passed off the object support means, the biasing means returns the lever to the inoperative position.

Similarly when a medical item is placed onto the object support means 36, the lever 48 is pivoted in an opposite direction. This causes the permanent magnet to trigger the magnetic field detection switch element 62. This generates a signal indicating that one object unit has been added to the storage location on the object support means. Although in the preferred embodiment magnetic field detection switches are used, other suitable switches such as three-way toggle switches, photo sensors, optical encoders, capacitive or inductance sensors and the like may be employed as sensors to achieve and generate the additive and subtractive article registration signals. Likewise, the switch actuating means may assume forms other than a pivotable lever depending on the type of medical item and storage location involved. For

33

example, a linearly reciprocal lever, a flexible flap or noncontact type sensors may be used in other embodiments.

The microprocessor 66 receives through signal processing circuit 65 the signals generated by switches 60 and 62. The microprocessor contains software programs which record and count the state of the switches each time a change is detected. The number and direction of the changes are counted and stored as a count in the microprocessor. In addition, the microprocessor includes a computer program that enables it to be reset upon receipt of signals from a remote location. In the preferred embodiment, the microprocessor also has stored in association therewith a location identifying indicator that is representative of a number and/or other data uniquely associated with the particular hook register. Each hook register and other dispensing apparatus in the system of the preferred embodiment has a location identifying indicator associated therewith.

The electronic circuitry of the inventory monitoring apparatus also has the ability to communicate its count information to other components of the system of the present invention. In each hook register, the processor 66 is connected through a ribbon cable 68 which is connected with an electrical coupling 70. Coupling 70 electronically couples with a communication bus 34. In this manner, circuit board 58 is enabled to receive power from a remote power source and is enabled to transmit and receive data through communication bus 34.

The operation of the hook registers 10 in the inventory monitoring and dispensing system of the present invention is best shown with respect to Figure13. Each of the hook registers is connected to the data bus 34. Each of the hook registers is connected to the data bus 34, which is connected to a hook controller shown schematically as 72. Hook controller 72 includes a processor and a data store therein which are operable to communicate with each of the hook

34

registers 10. The hook controller 72 is operable to periodically poll each of the hook registers 10 on the data bus. The hook controller reads and receives the count information in each of the hook registers and stores it in conjunction with the location identifying information associated with the particular hook register from which the count was received. After the reading of the

5   count information in the register and transmission of the data to the hook controller 72, the count information in the microprocessor 66 may be erased so a new count can be started. Alternatively, the microprocessor 66 in the hook register may be programmed to store the count information and the time each such count was generated for a period of time while generating new count information. This can be done to assure that usage of items from any hook register can be

10   recovered even in the event of the failure of a hook controller. While Figure 13 shows only four (4) hook registers connected to controller 72, it will be understood by those skilled in the art that many more hook registers may be so connected on the data bus.

As a result of polling each of the hook registers 10, the hook controller 72 has in its associated processor and data store the count of units taken or added in conjunction with the

15   identifying information associated with each hook register. The hook controller 72 is connected by a further data bus 74 to a data terminal 76 sometimes referred to hereafter as a display terminal. Of course other hook controllers and controllers connected to other types of registers may also be connected to data bus 74. The data bus 74 is used to transmit and receive information from the connected controllers to the data terminal 76.

20   Data terminal 76 includes a display screen 78 which serves as a data output device. In the exemplary embodiment, screen 78 is a "touch screen" of the type known in the prior art wherein a user may input data by placing a finger adjacent to icons displayed on the screen. Sensors

35

overlying the screen sense the position of the finger and convert it to input data. As a result,

touch screen 78 serves as a graphical user interface which includes a data input device as well as

a data output device. In other embodiments other types of input devices and output devices may

be used. Data terminal 76 in the preferred embodiment further includes a card reader 80. Card

5   reader 80 may be used to read data encoded on a magnetic stripe of a user's identification card.

Of course in other embodiments of the invention other equivalent reader means for reading coded

objects or for reading a user's features such as fingerprints or retina pattern may be used

depending on the level of security desired.

In the operation of this embodiment of the invention, a medical technician who wishes to

10   operate the system and remove medical items from the hook registers 10 operates the display

terminal. The terminal screen outputs a visual prompt for the user to identify himself or herself

to the system by input of identifying data. In certain embodiments, the identification may be

accomplished by the user inputting an identification number assigned to the user by touching the

appropriate numbers on a graphical keypad presented on the screen of the display terminal such

15   as shown in the user log-in screen in Figure 38. In other embodiments, the user may be requested

to swipe their card in the card reader so that the magnetic stripe thereon may identify the user to

the terminal. In embodiments where high security is required, a user may be requested to input

both their card and a personnel identification number (PIN) into the display terminal. The PIN

has a predetermined relationship to the data on the card, and the data terminal may be operated

20   further only if a proper card and PIN are input.

When a user enters their identifying information at the display terminal, the display

terminal communicates through a local area network (LAN) 82 to a remote computer 84 which

36

includes a processor and a data store therein schematically indicated 85. Computer 84 may have

greater and faster processing capabilities and more memory than a display terminal. The

computer 84 has stored therein or in another computer operatively connected therewith,

information records associated with authorized users. If the data input by the user at the display

5   terminal corresponds to a record for an authorized user, then the display terminal will enable the

user to operate the system. In alternative embodiments of the system, one or more display

terminals may have the additional processing capabilities and the additional memory to perform

the functions of computer 84. In such cases the functions performed by the computer 84 may be

distributed among the display terminals, or among a network of numerous display terminals and

10   computers, each of which has an associated data store. It should be understood that unless

otherwise indicated, for purposes of the invention a network of operatively connected computers

and data stores is the equivalent of a single computer with a data store operatively connected

thereto.

Upon further use of the display terminal, the user may access certain information about

15   patients, medical items prescribed for use by patients, procedures or physicians which is stored in

records in the data store of the computer 84 or other computers connected to computer 84

through a local or wide-area network. In the preferred embodiment, the stored records include

information about patients. The user may select a particular patient at the display terminal. This

is preferably done by the user scrolling through a displayed list of patient names using "keys" or

20   "buttons" presented graphically on the touch screen. The preferred embodiment of the input

device includes appropriate programming of the display terminal to include a highlighting device

responsive to a user bringing a finger adjacent to an area of the touch screen indicating the

37

patient or other data selected. The selected item is highlighted to indicate it has been selected

and further processing will use the highlighted data. However, other input devices for selecting a

patient name and other input data may also be used.

In one exemplary embodiment, the display terminal displays a patient browser window

5   222 shown in Figure 28. The patient browser window includes a list of patients. These patients

are preferably patients that are assigned to patient rooms or other areas assigned to the display

terminal through programming in the display terminal or the computer 84. Alternatively, the

display terminal or connected computer may be programmed to display a list of all patients in an

institution at the display terminal.

10   The patient browser window includes a previous page button 224 and a next page button

226 that enables a user to review or "scroll" through the stored list of patient names which covers

several "screens." Of course, the "buttons" are preferably areas on the touch screen produced by

the display to direct the user to touch an area which causes the display terminal and/or connected

computer to execute a particular function.

15   Patient browser window 222 further includes an add/find button 228. The add/find

button 228 enables a user to either add a patient to the system or to find a patient already in the

system. Upon pushing the add/find button 228 the user is presented with another screen which

prompts the user to indicate whether they wish to add a patient or look for a patient who is

already in the system, perhaps in another area of the institution. Further screens are presented

20   based on the selection input by the user. For example if the user wishes to find a patient, a screen

will request the user to input information about the patient such as the last name. The user may

be provided with a representation of a keyboard on the touch screen for this purpose, or the

38

display terminal may be connected to an alternative input device such as a keyboard. Upon completion of the input of information, the user indicates that the input is complete through the input device. The connected computers are then operative to attempt to find records related to such a patient and display the information on the touch screen.

5   Alternatively a user may press a sort button 230 to attempt to find a patient. The display terminal and connected computers are operative to sort the list of patients by name and display the sorted list on the touch screen of the display terminal as shown in Figure 28. Touching the sort button changes the manner in which patients are displayed on the touch screen. For example, touching the sort button may cause it to change the screen so that patients are displayed

10   sequentially by room. The designation on the sort button 230 correspondingly changes as it is togged to indicate how patients are being displayed.

Alternative displays may also be provided in connection with the sort button 230 by programming the computer and the display terminal to sort and display patient data from various patient records in different ways. These may include for example sorting patients by area or

15   ward, by physician, by gender and in other ways that are useful to users of the system. Each time the sort button 230 is touched or "toggled" a new sorted display of patients or information is provided on the touch screen and the designation on the sort button changes to correspond with the method of sorting. The sort button repeats the sequence after it has been toggled through all the sort options.

20   Returning to a discussion the functions associated with add/find button 228, after first pressing this button the user is presented with another screen where they may indicate that they wish to add a patient. By providing this indication to the display terminal through an input, the

user is prompted by screens presented on the display terminal to input the information needed

concerning the new patient. The user can input the information through an input device such as a

representation of a keyboard on the touch screen of the display terminal, or through an input

device such as a keyboard attached to the display terminal.

5   The display terminal and connected computers are programmed to prompt the user to

input the necessary information to add at least one record for the patient to the database of the

system. The inputs may also include optional information about the patient as may be available.

After inputting the information the display terminal prompts a user to institute an "enter"

command which adds the patient and associated information to the system.

10   In response to the patient information being entered, the connected computers are

operative to establish records for the patient in accordance with their programming. They are

also operative to establish programmed correlated relationships among records and/or items of

stored data related to the new patient. Further in accordance with programming of the system,

the system may prompt users of other types of terminals or other data input stations to generate

15   records or input data into records concerning this new patient.

Upon finding the desired patient name in a patient window such as window 222, the user

designates that patient's record by touching the patient's name on the screen. Thereafter, the user

may remove medical items from the hook registers that are needed by that patient. When this

occurs, the number of units of each item removed from a particular hook register is stored as a

20   count in the microprocessor in each hook register. This information is then transferred to the

hook controller 72 when the hook register is polled, and is thereafter transferred to the data

terminal 76 when the hook controller 72 is accessed through the data bus 74 by the data terminal.

40

As a result, data representative of both the patient and the location and number of units of medical items used for that patient is available in the data terminal.

When the user signs off the data terminal which is done by pushing a log-out button 232, or selects another patient (indicating that the items for the prior patient have been taken), the data terminal preferably transmits the information corresponding to the counts and location numbers of the items used for the selected patient through the LAN 82 to the data store in the computer 84 or another operatively connected computer or data store. Alternatively the data terminal may be sending the data while the user is logged on. The computer 84 functions to correlate the count and location numbers with a medical item record which indicates the types of items stored and the location. This provides an indication of what was used for the patient. In addition, the processor and memory in the computer 84 serve to update the record related to the patient to indicate that the items taken were used for the patient so that the patient may be charged therefore. The location records related to medical items preferably includes or may be referenced to pricing information so that patient may be automatically billed. In addition, the computer 84 also updates its records concerning the number of medical items remaining in storage in each location.

The computer 84 is operable in this embodiment to maintain a continuous real time record of how many units of medical items are stored in each of the locations. If the number remaining in any location has reached a lower limit, the computer 84 is programmed to provide a warning of the need to replenish the supplies at that location to an administrator terminal or workstation 86. The administrator's workstation 86 is also a computer with a processor and data store and is connected through the LAN. It has input devices such as the keyboard and mouse

41

shown and an output device such as the screen shown. The terminal 86 may also have other

input and output means such as a touch screen, spoken word recognition, audio output or signal

outputs connected to printers or other devices. Of course, the need to replenish the supplies may

be indicated on the screen at the administrator's workstation or in other output locations

5   including the data terminals in the area where the hook registers need to be replenished.

In other embodiments, the data terminal may be used to help medical technicians or

nurses select medical items for patients. The computer 84 or other connected computers have

associated data stores which include records which contain information on medications

prescribed for patients or medical items to be used in the treatment of patients. The computer 84

10   also preferably includes records related to medical procedures as well as physicians in its data

store. This information may be accessed at the display terminal by the medical technician or

nurse who is obtaining supplies for use in such a procedure. By accessing the stored data records

related to the procedure, the technician can read a record which includes information such as the

items that are normally used in such a procedure. As a result, the technician may note these

15   items and may remove them from the hook registers while viewing the procedure record to

ensure that everything normally needed is transferred to the operating room. In addition, the

procedure records may be accessed in connection with a physician record related to a physician

who will perform the procedure. Such records may include additional medical items that the

particular physician requires to have present in an operating room when conducting a particular

20   procedure. This may include additional medical items or particular types of medical items that

the physician prefers. It may also include convenience information such as the particular type of

music the physician prefers to have played in the operating room during a procedure or other

items that the particular physician prefers to have available.

In other embodiments of the invention, computer 84 or other connected computers may

be programmed to have in its data store, and may provide in response to a request at a display

5   terminal, a schedule of procedures in a particular hospital operating theater. This enables the

medical technician or nurse participating in the procedure to locate the patient scheduled for a

procedure using the display terminal, and to access therewith the records related to the physician

and the medical items that will be needed for the procedure. As a result, the technician or nurse

may go to the hook registers, obtain the necessary medical items and have them immediately

10   charged to the patient's account. Alternatively, if medical items which are dispensed are

involved, the items may be simultaneously dispensed together. If after the procedure not all of

the items that were originally taken were used, the items may be returned to inventory and

credited to the patient's account if appropriate. Alternatively, such items that are partially used

may need to be wasted. This is generally done by the user identifying himself or herself to the

15   display terminal 76 and again identifying the patient to the system using the touch screen 78 in

the manner previously described. Replacing the unused items back on the hook registers 10

automatically creates a record that such items were returned and the patient's account will be

credited in the computer 84. Alternatively returned medications and wasted items are returned to

designated areas and records thereof are generated and stored.

20   Because of the large number of records that are stored in the data store of the computer 84

and other connected computers, a large number of reports related to inventory usage may be

generated. This can be accomplished by using database software such as Paradox® in computer

43

84. Alternatively, relational database software such as Oracle® or other data storage software may be used. Further, because the inventory at each location is monitored, messages requesting transfers of inventory from areas where there are excess units to areas where there is a need can be automatically generated by the computer and displayed at the administrator's workstation.

5   The computer 84 also operates to keep a running tally in the data store of what has been used by each patient as well as what has been taken by each user and used by patients of each physician. This further allows monitoring of usage and allows potential abuses to be uncovered. The computer 84 is ideally programmed to look for patterns of dispensing activity that have been programmed into the computer's memory as potential abuses and to display a report thereof at the

10   administrator's workstation. Such potential abuses may include taking particular items at abnormally frequent intervals. The computer 84 may also be programmed to provide reports from the database concerning what particular users have dispensed during a given time period and what particular physicians have used or prescribed for patients.

In the described embodiment of the system of the present invention, the administrator's

15   workstation 86 is used as a primary tool for the monitoring of inventory. The administrator's workstation is used to program the particular type of medical item stored in the location at each of the hook registers and in other types of registers in the system. This is done by creating a record for each location in the data store. The administrator's workstation is also used to set the level of the minimum acceptable number of units of each item at each location so that an

20   indication may be given of a need to replenish or transfer stock. This is programmed as a minimum for each location, and an indication is given when the minimum is reached. Further, the administrator's workstation preferably includes electronic ordering capability so that when

44

supplies of a particular item are reduced to a particular level, a purchase order to replenish the stock is sent automatically to the manufacturer. The ordering and source information is also optimally part of or referenced with the associated record with the item in the data store. As a result, the administrator's workstation is programmed so that when the quantity of an item on

5   hand falls to a particular level, an order is communicated to the manufacturer of the needed item directly over a telephone or other data line via a modem, indicating electronically the item needed, an order quantity and a date by which the items must be received. The order quantity data may be preprogrammed or may be calculated automatically by the computer using a program that generates the order quantity based on rate of use. Likewise, the delivery date may be a

10   programmed time period after issuance of the order, but may also be programmed to be a rush order if the "on hand" quantity has fallen to a second lower level or if the use rate is above a programmed level.

        The administrator's workstation may also be used to establish records for authorized users and to set varying levels of security for authorized users at different types of display terminals.

15   Although in the described embodiment, the administrator's workstation is the primary control for the system of the present invention as shown in Figure 13, the hospital's other computer systems including the admission-discharge-transfer (ADT) system 88 and the hospital information system (HIS) 90 are also connected to the local area network 82. This enables the patient data in the computer 84 to be input and output to the ADT system 88 and records relating to patient activity

20   or other activities to be received from or stored in the HIS, which is typically the long term data storage facility related to patients. The system is also preferably connected to other computer systems in the institution such as a pharmacy system 89 which provides information on

medications prescribed for such patients. The system may also be connected to systems in dietary and food services and in other institution areas. Each of these systems may contain multiple processors and data stores which transmit selected data to and from the LAN 82. This enables the exchange of data throughout the hospital's computers which facilitates both record

5   keeping, patient billing and monitoring of its inventory.

The hook registers 10 which are optimally constructed for supporting hanging items are only one type of dispensing device that can be used with the present invention. Figures 4 through 6 reflect a further embodiment of an inventory monitoring apparatus designated by the numeral 110. Apparatus 110 is called a box register as it is optimally adapted to include storage locations

10 for holding boxes or box-like articles. Box register 110 includes an elongated housing 112 including an upper wall 115, a lower wall 116, end walls 118 and 120, a front wall 122 and a rear wall 124. Like housing 12 of hook register 10, housing 122 may be fabricated from any durable material such as plastic or metal. Although not shown, it will be understood that a clip assembly similar to clip assembly 26 of Figures 1 and 2 or a similar attachment mechanism may be used to

15 detachably fasten the housing to a wall. Alternatively, apparatus 110 may rest on a level shelf, tabletop or reside in a cabinet. Each box register 110 is connected to a communication bus 74 (see Figure 13).

With regard to the box register, in this embodiment, an object support means is represented by reference numeral 136 which support means may assume the form of a receptacle

20 having at least one or preferably a plurality of compartments or object storage sites 138 which are locations wherein medical items may be stored. In this embodiment, object support means 136 is constructed as a multiple compartment, heavy gauge, stiff metal wire rack including a pair of

46

upright truss-like end walls 139, a plurality of spaced apart storage site divider walls 140 situated

between and generally parallel to the end walls 139 and a plurality of transverse members 141

affixed to the end walls 139 and divider walls 140. The end walls 139 are desirably secured by

suitable mechanical fastening means 142, such as nuts and bolts or the like to lower wall 116 (as

5   shown) or any other wall of the housing 112.

As shown in the figures, the object support means 136 is adapted to support objects 144

of substantially uniform dimensions (one of which is shown in phantom in Figures 4 through 6)

in a substantially upright orientation. For example, objects 144 may be generally uniformly sized

relatively thin boxes or similar packages which may contain various designated types of medical

products. The object support means as illustrated is thus capable of supporting an object on four

sides thereof, i.e., the bottom, back and both lateral sides of the object (see Figures 4 and 5). In

this fashion, an object 144 may be removed from the object support means 136 by lifting it

forward (to the right as shown in Figure 5) and/or upward. The bases of the divider walls 140 are

situated at a lower elevation than the upper wall 114 of housing 12 (Figure 5) whereby the

15   objects 144 are caused to be tilted slightly rearwardly such that the back sides of the objects

maintain contact with the rear of the object support means 136.

Although the described embodiment of the object support means 136 supports the objects

144 such as boxes in substantially upright or vertical position, the present invention also

contemplates rack geometries whereby objects may be supported substantially horizontally, at

20   acute angles or in a staggered array incorporating one or more angular support orientations.

Further, the spacing between the divider walls 140 need not be uniform in which case storage

sites 138 of variable dimensions may be provided in the same object support means 136. Of

47

course the object support means 136, like housing 112, may be fabricated of metal or from any high strength substantially rigid plastic or other suitable material.

Box register 110 includes switch activating means 148. The switch activating means 148 includes one or more levers pivotally mounted at 150 (see Figure 6) to housing 112 in a manner

5   described hereafter. The levers 148 correspond in number to the number of compartments 138 which are the storage locations provided in the object support means 136. A first end of each lever 148 projects from the housing 112 into a respective one of the storage sites 138 and a second end of each lever extends into the housing as most clearly seen in Figure 6. The first end of each lever protrudes from the housing for a distance sufficient to be contacted and displaced

10   by an object 144 when such object is added to the object support means 136. Biasing means later discussed return the levers to inoperative positions upon removal of an object from the corresponding storage site.

Referring to Figures 4 and 6, as is the case with the hook registers described above, the box registers likewise have printed circuit boards therein designated 158 one of which is shown.

15   Circuit boards 158 are mounted in the interior of housing 112. Circuit boards 158 include printed circuitry and other circuitry components which are not illustrated or described in detail except to the extent necessary for a proper understanding of the present invention.

Electrical sensor means are supported by and electrically connected to circuit board 158. The sensor means generate signals indicative of the placement of an object onto and the removal

20   of an object from the object support member 136. According to the preferred embodiment, the sensor means comprises one or more discrete force actuatable switches 160 such as snap-type internally resilient dome switches or other type electrical switches. Switches 160 are spaced

48

apart along the length of circuit board 158 and correspond in number to the levers 148 whereby

the second end of each lever operates a separate switch.

The switches 160 generate real time counting signals indicative of the total inventory of

objects 144 carried by the object support sites which are occupied and those which are

5   unoccupied at any instant in time. Thus when a lever 148 is caused to pivot in one direction by

an object that is placed into a storage location, the second end of the lever closes its respective

switch 160. This is reflected by the solid line image of lever 148 depicted in Figures 5 and 6.

Switch 160 in turn generates a registration signal indicating that an object has been placed into

the storage location and at which storage site the object has been added.

10   Conversely, when an object is removed from the object support means, the biasing force

from the internal resilience of the dome switch 160 returns the lever to its inoperative position as

is reflected by the dash line image of lever 148 illustrated in Figures 5 and 6 whereby the switch

is open. In this position, the switch generates a registration signal which reflects that an object

has been removed from the storage location. Additionally, if mechanical switches other than

15   dome type or other similar switches possessing internal resiliency are employed as the electrical

switch means, then biasing means such as springs or elastomeric means may be provided to

assure that the switches change electrical condition upon removal of objects from the object

support means 136. Alternatively, certain switch types have built-in springs which provide the

biasing force. Although dome type switches are used in embodiments of the box registers, other

20   suitable sensor means such as two-way toggle switches, momentary contact switches, photo

sensitive switches, capacitive or inductance sensors and the like may be employed to affect the

generation of additive, subtractive and object locating registration symbols.

49

Figures 7 to 8 show on an enlarged scale a lever 148. The lever desirably includes a pair

of opposed notches 161, 162 which generally separate the lever into its first and second ends and,

in cooperation with mating slots provided in the front wall 122 of housing 112, establish the

pivotal connection 150 of the lever relative to the housing. Further, each lever 148 is preferably

5   provided with a downwardly sloping lip 163 at the leading edge of its first end to facilitate

insertion of the objects 144 into the storage sites 138.

The signals indicating changes in the status of the switches 160 are transmitted by wire or

other acceptable signal conducting means 164 whereupon they are detected by a signal

processing circuit 165 which converts the signals to an appropriate form to be received and

10   counted by a microprocessor 166. The microprocessor 166, like microprocessor 66 of the hook

registers 10 described above, contains software programs which record the state of the switches

each time a change is detected. The microprocessor 166 also counts and stores a count indicative

of the number and direction of changes in state as they occur. Further, the microprocessor 166

includes the unique location identifying indicator associated with each of the storage locations in

15   which any changes in the presence of a medical item have occurred. Alternatively, the

microprocessor 166 may keep track of the times such changes have occurred.

While not illustrated it will be appreciated that the hook and box registers are preferably

remotely powered through the associated bus connections. In other embodiments they may be

locally powered. Further, in other embodiments the registers may include LED or LCD displays

20   on the registers for indicating the powered condition of the particular register or the fact of a

change in the status of inventory items at the location. Of course suitable LED or LCD indicators

may also be used for other purposes such as indicating the particular type of item to be stored,

that the register is in a restocking mode, or that the amount of inventory stored in the location has

fallen below a critical level. This is accomplished by programming in computer 84, or

programming in the other processors connected to LAN 82 to output such an indication under

such conditions.

5   An alternative embodiment of a box register 110' is shown in Figures 9 through 12. Box

register 110' is similar to the previously described box register 110 except as expressly noted

herein. The box register 110' includes a plurality of compartments 126 which are separated by

divider walls 128. Each compartment has located therein a lever 130, which is movable about a

pivot 132 (see Figures 11 and 12). The lever includes an object engaging leg 123 and a switch

10   actuating leg 133. The leg 133 is engageable with an actuating projection 134 of a switch 135.

The switch 135 includes an internal spring which biases the actuating projection outward from

the switch. The switch operates to change its electrical condition when the actuating projection

is depressed.

Objects or items such as boxes holding medical supplies are stored in the compartments

15   126. The presence of an object in the compartment engages the object engaging leg 123 and

moves the associated lever 130 to the position shown in phantom in Figure 11. In this position

lever 130 is in abutting relation with a stop member 152 which bounds the rear of the

compartment. The stop 152 prevents the object engaging leg of lever 130 from being rotated

rearward beyond the position shown in phantom. When object engaging leg 123 is in

20   engagement with stop 152, switch actuating leg 133 depresses actuating projection 134 of switch

135 resulting in the switch having a first electrical condition.

Upon removal of the box or other object from the compartment, actuating projection 134 moves outward in response to the biasing force of the internal spring as the object disengages lever 130. Outward movement of actuating projection 134 causes switch 135 to change its electrical condition. As in the earlier described embodiment of the box register this change is noted in conjunction with the location information in the box register's associated microprocessor, similar to microprocessor 166.

Although the box registers shown are a single tiered rack, the object support means may comprise a multi-tiered rack or a plurality of rows and/or columns of cubicles whereby each of the storage sites or cubicles may be appropriately fitted with a switch actuating means such as a lever.

In the exemplary form of the invention, the box registers are connected through bus 74 with the display terminal 76. The display terminal periodically reads the count information in the microprocessor 166 associated with each of the box registers and receives changes in the count information associated with each of the storage locations in the box registers.

A user may operate display terminal 76 to indicate the appropriate patient for which material taken from the box registers will be used in the manner previously described with regard to the hook registers. In addition, the administrator's workstation is used in the setup of the system to assign the particular type of medical item to be stored in each location in the box registers which is stored in a record in computer 84. However, unlike the hook registers which may store a substantial number of units of the particular type of medical item in each location, a box register is adapted to store only one such item in each location. Therefore, in some

embodiments several adjacent locations in the box register are designated for containing the same type of medical item.

As is also the case with the hook registers, a user of the system who is replenishing inventory to the box registers may operate the display terminal to so indicate using the touch screen data entry device that he or she is replenishing inventory. In this case, the records in computer 84 will be updated to indicate the units of inventory added in each of the storage locations. No patient is credited for the items stocked in the locations and a record in the data store concerning the number of such items on hand but not yet placed for use in a location is also updated. In alternative embodiments, a bar code is applied on the various items stored in the hook and box registers. A bar code reader or scanner shown schematically as 104 in Figure 5 is positioned in the hook and box registers so that the code on the item is read as it is placed or removed from a location. The bar code scanner generates signals that are interpreted by software for reading bar codes which runs in computer 84 or another terminal in the LAN 82. A data store associated with the software includes information which correlates each bar code identifier with a particular medical item. This provides a check that the item actually stored or taken is the type that is recorded as stored in that location. If an error is made an alarm may be given, either at the register, display terminal and/or the administrator's workstation. Alternatively, the bar code on the medical items may be used to "set up" the system, so that the system records the fact that a particular medical item is stored in a particular location as a result of having read the bar code thereon as the item is placed therein. This avoids the need to program the administrator's workstation with this information. The bar code scanner can be provided in addition to the indicator which indicates an item is added or removed. Alternatively, the bar code may be read

53

as each item is removed from a location on a hook or box register and the use for the patient of

the item recorded directly in response to reading the bar code signals and identifying the patient

at the display terminal.

The information included in the data store with respect to particular items may also

include a date by which perishable items must be used. The user stocking such items in the

locations can input such information using the input device of the data terminal. Items having a

limited shelf life are preferably stored in the box registers where the "use by" date can be

uniquely associated as part of the record for the only item in the location.

The system can also be used with other types of devices that are used to indicate that an

item has been taken for a patient. One such device is a manual input register where a nurse or

other medical technician manually indicates that an item has been taken.

In one embodiment a manual register is structurally similar to box register 110' except

that it does not include compartments or levers. The actuating projections of the switches are

connected to manually engageable buttons. The system is programmed so that the momentary

change in electrical condition of a switch resulting from depression of a particular button

represents the taking of one unit of a particular item from storage. Preferably each button is

labeled with indicia representative of the item that it is associated with.

In the case of a manual register, the nurse or medical technician queues up the patient

who will receive the items on the screen of the data terminal and touches the screen to select that

patient. The user pushes each button on the manual register corresponding to the type of item

taken. By pressing the button once for each unit of an item taken, data is stored in the

microprocessor associated with the manual register which is representative of the particular

button location pushed and the corresponding count associated with that button. This information is correlated with the patient record in the same manner as occurs with the hook registers and box registers.

The system of the exemplary embodiment of the present invention may also be used in

5   conjunction with other types of dispensing devices. An example of such a device is an electronic lock drawer 96. The electronic lock drawer may be used to store narcotics or other articles, the use of which is highly restricted and which are not suitable for storage in a hook or box type register of the type previously described. Alternatively, the electronic lock drawer may comprise a secure enclosure housing hook registers or box registers in its interior. The function of the

10   electronic lock drawer is to hold the restricted items and provide access thereto by opening a locking mechanism of the unit only when a set of predetermined conditions are satisfied. The electronic lock drawer is but an example of one of many possible storage or dispensing devices which incorporate an access control device which selectively controls access to the storage locations for medical items or which makes medical items accessible by dispensing them to a

15   user.

In one embodiment of the invention the electronic lock drawer is connected to and the opening thereof controlled through an adjacent data terminal 98. Data terminal 98 is similar to data terminal 76. Data terminal 98 is connected to the electronic lock drawer 96 and is operable to unlock the lock thereto upon receipt of appropriate signals from computer 84. Of course

20   although only one electronic lock drawer is shown in connection with data terminal 98, additional electronic lock drawers may be connected thereto.

In the exemplary form of the invention, information about each type of restricted material housed in each electronic lock drawer is stored in a record in the computer 84. To gain access to these materials a user may first identify himself or herself to the data terminal in the manner previously described. Preferably for highly restricted items, computer 84 requires not only a user to input an identification card and PIN number but also a second authorized user to input their coded card and PIN number. The purpose for requiring two (2) authorized users to be present to open the electronic lock drawer is so that the items removed and their disposition may be verified.

Preferably, the computer 84 has stored in the patient record, information about the medications that the patient has been prescribed or is authorized to be given. As a result, the user may use the data terminal to select the patient name and to request the opening of the electronic lock drawer so the user may take the medication for the patient. This is done using the touch screen of the data terminal as an input/output device. Thereafter, upon proper input of a further authorized user's verification information, the electronic lock drawer will unlock in response to signals sent from the computer 84 to the data terminal 98 and from the data terminal 98 to the lock drawer 96. Thereafter, the user may remove the medication from the lock drawer in the presence of the verification user and reclose the unit. Upon the user inputting a verification input to the data terminal that the medication has been taken, the associated record of use and the charge therefore is automatically added to the patient's account by the computer 84.

It does not matter in this exemplary embodiment if a medication that is stored in the electronic lock drawer is not listed as one the patient is authorized to receive in the patient's records in the computer 84. The authorized user may still access the electronic lock drawer. A

user may input a request through the data terminal for a listing of medications available. In response the computer 84 outputs to the data terminal a listing of the available medications and the dosages. The computer may also provide information on the location of each medication. The user may then select a particular type of medication and then input through the data terminal

5   a request for a listing of patients which again is provided from the records in the data store of computer 84. By selecting the patient who is to receive the medication (and when appropriate providing the necessary verification from a co-authorized user) the appropriate electronic lock drawer will unlock and allow access to the medication. Upon verification input to the data terminal from the user that the medication has been removed, the computer will charge the

10   patient's account therefor by updating the patient's record. Of course as is the case with the other medical item storage locations previously described, computer 84 also operates to keep track of the inventory of various items inside the electronic lock drawer 96 to assure adequate stock. The computer is also programmed to record the users and verification users who have removed items from the electronic lock drawer and the types of items taken so that any shortages or patterns of

15   abuse may be automatically noted. Further, as discussed previously, data terminal 98 may be used to access information in the computer concerning procedures and physicians so that items in the electronic lock drawer 96 may be taken to an operating theater in advance of a surgical procedure.

Of course data terminal 98 may be used like data terminal 76 to credit a patient's account

20   for items returned from inventory as well as to indicate replenishment of inventory in the electronic lock drawer. If a narcotic substance is to be returned the computer is programmed to have a verification user verify the returns. Returns are preferably made into special one-way

57

receptacles so that returned items cannot be removed by unauthorized persons. This may be done in the manner shown in U.S. Patent Nos. 5, 957,372 and 5,961,036 the disclosures of which are incorporated herein by reference.

Another type of dispensing device used in embodiments of the invention are devices which provide storage for medical items under controlled environmental conditions. This is represented by a refrigerator 450 shown in Figure 13. Refrigerator 450 has an interior area which holds medical items of one or more types therein. Access to the interior area of refrigerator 450 is controlled by a lock module 452. Lock module 452 controls access to the medical items in the interior area of the refrigerator. The lock module 452 is controlled from the display terminal 98. The operation of the refrigerator and the lock module is generally similar to that discussed for compartments in the electronic lock drawer 96. It should be understood that embodiments of the invention may include subcompartments within the interior area of the refrigerator, and access to each subcompartment may be controlled selectively from the display terminal or from other computers within the system. The system may also have a plurality of refrigerators or other environmentally controlled chambers, and access to each may be controlled individually. This enables providing various levels of security for the different types of medical items housed in each refrigerator.

Access to the interior areas of the refrigerators is obtained by one or more authorized users as required by the programming of the system. This is accomplished in the manner previously discussed in connection with the electronic lock drawer. A signal from the display terminal 98 or other connected computer is sent to the associated lock module so as to enable the user to access the interior area of the refrigerator and the medical items held therein.

The refrigerator 450 and lock module 452 of one exemplary embodiment of the invention are shown in greater detail in Figures 50-54. As shown in Figure 50 refrigerator 450 has a door 454. Door 454 is a conventional refrigerator type door that includes a handle 456 on an exterior area thereof. Refrigerator 450 also has a body 458. Body 458 has an interior area or compartment which is maintained at a temperature below ambient temperature suitable for the type of medical items intended to be housed therein. It should be understood that the interior area of the refrigerator 450 in some embodiments may be a single storage location in which one or more types of medical items are housed. Alternatively the interior area may be divided into several storage locations. These storage locations may be open storage locations or may be subcompartments to which access is further controlled by electronic or other types of locking mechanisms. The exemplary embodiment of the invention provides for records to be maintained in the data store associated with the computer concerning the type and number of medical items stored in each storage location.

Door 454 in the embodiment shown may be swung open in the conventional manner so that authorized users may gain access to the interior area of the refrigerator. Access to the interior area is controlled by signals which are sent to the lock module 452. The lock module is mounted on an exterior surface of the body 458 in the embodiment shown. A bolt support bracket 460 is mounted to an exterior surface of the door 454. As later discussed bolt support bracket 460 is in connection with a bolt. The bolt is normally accepted and held by the lock module 452 so as to maintain the door 454 in a closed condition. The lock module 452 is operative to release the bolt in response to an appropriate signal so that an authorized user is enabled to access the interior area of the refrigerator.

The lock module 452 includes a key cylinder 462. Key cylinder 462 is part of a manual unlocking mechanism that enables opening the refrigerator door 454 using a key. This provides an alternative way for an authorized user to access the interior area of the refrigerator in the event of a failure which prevents the interior area from being accessed electronically or alternatively for emergency or restocking purposes. The lock module 452 also includes a visual indicator 464. The visual indicator 464 in the preferred embodiment is an LED type indicator which indicates that the lock module 452 has received the signal which enables the door 454 to be opened. In alternative embodiments other types of indicators or additional indicators may be used.

As shown in Figure 52 the lock module 452 includes an enclosure 466. The enclosure is secured to the exterior surface of the body 458 of the refrigerator by a plurality of fasteners 468. In the preferred form of the invention the enclosure 466 includes an exterior cover which restricts access to the fasteners after the enclosure 466 has been installed on the refrigerator. The preferred form of the invention is retrofit to an existing refrigerator or similar device by attaching the lock module 452 onto the exterior of the device and adjacent to the door thereof. Once installed using the fasteners 468 a cover is installed on the enclosure so as to minimize the risk of tampering.

As shown in Figure 52 the lock module of the exemplary embodiment includes a pawl 470. The pawl is mounted in rotatable relation about a pivot 472. A spring 474 is attached to the pawl by a pin 476. The pin and said spring are positioned relative to the pivot 472 so that the pawl 470 moves through an over center position during its operation. This enables the spring 474 to apply a force which biases the pawl to rotate about the pivot either in a first rotational

60

direction or in an opposed rotational direction depending on the side of the pivot 472 on which the pin 476 is currently positioned.

The pawl 470 includes a recess 478 which receives a portion of the bolt therein in a manner later discussed. The recess 478 extends between a first leg 480 and a second leg 482 of the pawl 470. A sensor 484 is positioned to sense the position of second leg 482. Sensor 484 may be an optical or a magnetic type sensor that operates to sense leg 482 adjacent thereto. Sensor 484 is mounted on a bracket 486. Second leg 482 includes a tapered surface 488 the purpose of which is later discussed.

As best shown in Figure 54 pawl 470 includes a third leg 490. Leg 490 is bounded by a tapered surface as shown. A lever 492 includes a tapered step 494. Tapered step 494 is engageable with third leg 490 of the pawl 470 as shown. The tapered step 494 is part of a releasable catch for holding and releasing the lever and the pawl.

Lever 492 is rotationally mounted about a pivot 496. Lever 492 is biased to rotate about pivot 496 in a counterclockwise direction as shown in Figure 54 by a spring 498. A solenoid 500 is mounted in enclosure 466. Solenoid 500 includes an actuator rod 502 which is biased upwards as shown in Figure 54 by a spring.

Actuator rod 502 is in connection with a pin 504. Pin 504 is engageable in a recess 506 in level 492. It will be appreciated that movement of the actuator rod 502 in a downward direction as shown in Figure 54 rotates lever 492 in a clockwise direction. When the solenoid 500 deactivates, the actuator rod 502 rises and the lever 492 returns to the position shown in Figure 54 due to the biasing force of spring 498. The arrangement of the pin 504 and the recess 506 enable the lever 492 to be movable other than by solenoid 500. As shown in Figure 54

cylinder 462 has a projection 508 attached thereto. Projection 508 is rotatable when a proper key

is inserted in the lock cylinder. Rotation of projection 508 enables the projection to engage lever

492 at the opposite end of the lever from recess 506. Moving lever 492 upward with projection

508 from the position shown in Figure 54, moves the lever in a manner comparable to solenoid

5   500. This enables the lock module 452 to be changed from a locked condition to an unlocked

condition in response to either a signal to the solenoid 500 or alternatively by a proper key

inserted into cylinder 462.

As shown in Figure 53 bolt support bracket 460 includes an interior bracket portion 510.

Interior bracket portion 510 is attached to an exterior surface of door 454 of refrigerator 450.

10   The interior bracket 510 is attached to the door by fasteners 512 only the heads of which are

shown. In the preferred form of the invention the interior bracket portion 510 extends adjacent

and is attached by fasteners to both the front and side surfaces of the refrigerator door. Interior

bracket portion 510 is attached to a bolt 514. Bolt 514 includes a pair of spaced legs 516 and a

transverse rod 518 which extends between the legs.

15   A cover 520 is mounted in overlying relation to the fasteners 512 so as to restrict access

thereto. Cover 520 is engaged to the underlying interior bracket portion 510 by fasteners 522

only one of which is shown. As best shown in Figure 50 the cover 520 and the bracket 510 are

constructed so that when the door 454 of the refrigerator 450 is closed, a surface 524 of the bolt

support bracket is in close abutting relation with the lock module 452. This restricts access to the

20   bolt 514 and minimizes the risk of tampering therewith.

As shown in Figure 54 when the refrigerator door is closed the bolt 514 extends in the

interior area of the enclosure 466 of the lock module 452. In the locked position the rod 518 of

62

the bolt 514 is positioned in the recess 478 between the legs of the pawl 470. In this locked

position the third leg 490 of the pawl is prevented from moving in a counterclockwise direction

by engagement with the tapered step 494 on the lever 492. Likewise the pawl 470 is prevented in

this position from moving in a clockwise direction by engagement with a pin 526 and the sensor

5   484 and its supporting bracket. This prevents the refrigerator door 454 from being opened.

When it is appropriate to open the door of the refrigerator a signal from the display

terminal 98, or other operatively connected computer or device in the system, is transmitted to

solenoid 500. The signal causes actuator rod 502 to move downward. This pivots level 492 in a

clockwise direction about pivot 496. The movement of lever 492 disengages the catch holding

10   third leg 490 of the pawl 470 engaged with the tapered step 494. The bolt 514 is enabled to

rotate pawl 470 in a counterclockwise direction about pivot 472. As spring 474 moves into an

over center relation, leg 482 pushes on the bolt to bias the door toward the open position.

The signal which activates the solenoid 500 also preferably causes illumination of the

LED 464 so that a user is aware that the refrigerator door may be opened. In the preferred

15   embodiment the signal from the display terminal lasts sufficiently long so that the user is enabled

to open the door. Once the door has been opened the signal may be discontinued. This is

preferably done in response to the sensor 42 sensing that the leg 482 of pawl 470 has moved

away from the sensor. Alternatively the signal enabling opening of the refrigerator may time out

after a period set in the computer, such as 30 seconds, in which case the solenoid ceases to retract

20   rod 502 and the lever 492 returns to the position shown in Figure 54.

In one exemplary embodiment, whenever refrigerator door 454 is opened a record

concerning the event is made by the computer 84 and stored in the data store 85. The record

concerning the opening is preferably stored in correlated relation with data representative of a user who caused the door to be opened. Other data correlated with the event preferably includes all of the data associated with other types of dispensers in the system. This may include for example, the particular medications to be taken from the interior area of the refrigerator, a

5 particular identified patient for whom the medications are to be taken as well as pricing and other information. Records concerning the numbers of medical items stored in the storage locations within the interior area of the refrigerator are similarly stored in the data store and adjusted based on the data input to the display terminal.

In an exemplary form of the invention the refrigerator door may remain open despite the

10 signal to the solenoid 500 being discontinued. In this condition the lock module 452 is in position ready to lock despite the door being open. When the signal to the lock module is discontinued the lever 492 returns to the position shown in Figure 54. In this condition the pawl 470 is rotated counterclockwise from the position shown in Figure 54. As the door of the refrigerator is closed the bolt 514 moves into the interior area of the enclosure 466. The rod 518

15 at the end of the bolt engages the tapered surface 488 on second leg 482 of the pawl and begins to rotate the pawl 470 in a clockwise direction about pivot 472. Pawl 470 moves in a clockwise direction against the force of spring 474. The tapered surface of the third leg 490 engages and moves on the tapered step 494 of the lever 492 so as to move lever 492 clockwise against the force of spring 498. Eventually as the bolt 514 moves inward the rod 518 of the bolt moves into

20 the recess 478 of the pawl. Thereafter continued movement of the pawl 470 in the clockwise direction causes the third leg 490 to move past the tapered step 494 on the lever 492. This causes the lever 492 to move downward again holding the pawl in fixed engaged relation therewith.

64

As the refrigerator door is closed the leg 482 of the pawl again moves adjacent to sensor 482. This provides a signal which is received at the display terminal 98. This signal indicates that the door has been closed. In a preferred embodiment of the invention the time of closing of the refrigerator door is preferably included as part of the dispensing event information in the data store along with the other associated information concerning the event. In alternative embodiments of the invention the timing routine may be provided either in the display terminal 98 or in the computer 84 so as to provide an indication when the door of the refrigerator remains open beyond a set time period. Such a condition may be indicative of a problem or tampering with the unit. Such an indication may be given either at the display terminal and/or at other connected terminals in the system. In other embodiments of the invention other approaches and techniques related to the tracking of items dispensed from the refrigerators and other controlled environmental chambers within the system may be used.

Another type of dispenser apparatus that may be used in the system of the present invention is the medicine dispenser 100 shown in Figure 13. Medicine dispenser 100 is also used for dispensing medical items that require high security such as narcotics. However, unlike electronic lock drawer 96, medicine dispenser 100 is operable to dispense only the particular item requested and to restrict access to all the other items housed within the medicine dispenser. As shown in Figure 13 the medicine dispenser is connected to a data terminal 102 that is similar to data terminals 76 and 98. The operation of the data terminal 102 in conjunction with the medicine dispenser 100 is similar to the operation of data terminal 98 in cooperation with electronic lock drawer 96. The difference in the use of the medicine dispenser is that in response to selection of the particular medical item (and the co-user verification if required) the medicine

dispenser will provide to the user the particular medical item requested in the quantity requested. As a result, the user is not required to locate the item as is required with the electronic lock drawer. In addition, the level of security required for dispense of medical items within the medicine dispenser can be varied depending on the level of security required for the particular

5   item. As a result, for some items in the medicine dispenser 100 it may be necessary only to verify that the user is an authorized user. For other substances, only selected authorized users (and co-users) will be given the substance. This may be done using the system as described in U.S. Patent No. 6,019,249 the disclosure of which is incorporated herein by reference.

The user interface of the display terminals of an exemplary embodiment are shown in

10   Figures 28 through 39. When the user accesses the system using the display terminal the user usually begins with the user log-in screen 302 shown in Figure 38. In the user log-in screen the user may input a user identification code using the "buttons" on the touch screen. The user may alternatively run their badge or other identification card through the card reader. After input of the user identification code the user inputs their PIN. After a user successfully accesses the

15   system through the display terminal for purposes of obtaining medical items for a patient, they are generally presented with the patient browser window shown in Figure 28. From the patient browser window 222 a user may manipulate the previous page and next-page buttons 224 and 226 respectively to display the patient for whom the medical items are to be taken on the screen. The programming of the display terminal includes a highlighting feature which serves as part of

20   an input device of the display terminal.

A patient is selected by a user's finger being brought adjacent to the touch screen which operates the display terminal to highlight the patient name as graphically indicated by the

66

highlighted band with a patient name in Figure 28. Upon touching the patient name in addition to being highlighted, the patient name is also shown at the top of the screen. This serves to identify this particular patient to the system as the one for which medical items are being taken.

From the patient browser screen 222 a user is enabled to remove items from the hook or box registers, in which case the items will be automatically indicated as taken for and charged to the patient. Similarly if an item taken for a patient is to be returned to a hook or box register, highlighting the patient name on the patient browser screen and replacing the item on the hook or box register results in the patient's records and account being credited for the returned item.

From the patient browser screen 222, more information concerning the selected patient may be obtained by the user touching a patient info button 234. Touching the patient info button 234 causes the display terminal to display the patient information window 236 shown in Figure 29. Patient information window 236 shows information about the patient. This can include vital statistics, the name of the treating physician, allergies that the patient may have and other information. In addition, the patient information window 236 also shows the assigned location of the patient in the facility. The patient information window 236 includes a close button 238 which a user presses to return to the patient browser window 222.

It should be noted that the patient browser window 222 as well as the patient information window 236 include a help button 240. The help button 240 is pressed by a user when they wish to obtain more information about using the system features that are currently accessed on the displayed window. The display terminal and the connected computer systems are programmed appropriately to provide instructions concerning the type of help most commonly needed when

accessing the particular patient windows. This makes the system easier to use and reduces the amount of training required before a user may effectively operate the system.

From the patient browser window a user may choose to review the medical items that have been taken for the selected patient. To do this a user touches a patient usage button 242. In response to selection of the patient usage button, the computer and display terminal are operative to display a patient usage browser window 244 shown in Figure 30. The patient usage browser window is operative to show medications and other medical items that have been taken for the patient as well as the amount and time that each medical item was taken. The patient usage browser window also includes a return button 246 and a waste button 248. The return button is selected in situations where a medication that has previously been taken for a patient is returned without being administered. The return button is used in situations where the returned item is a controlled substance such as a narcotic or is another item that cannot be freely dispensed or used for another patient. Selecting the return button generally enables a particular return drawer mechanism to open into which the medical item may be returned. By highlighting a particular dose of medication on the patient usage browser screen and completing a return transaction, the status of a medication may be changed from taken to return.

The waste button is used in situations where an item taken for a patient is to be returned in whole or in part and it cannot be used for another patient. This includes situations where only a portion of the medication is delivered and the balance is waste. Selecting the waste button 248 also preferably opens a return drawer into which the wasted item may be deposited. The patient's records are simultaneously adjusted accordingly in the patient records and on the patient usage browser window.

The operation of the return and waste buttons 246 and 248, respectively, along with a return drawer used in exemplary embodiments are shown in U.S. Patent Nos. 5,957,372 and 5,961,036 the disclosures of which Applications are incorporated herein by reference.

The patient usage browser window 244 also includes a discrepancy button 250. The discrepancy button is used in connection with dispensing medications as well as with the return and wasting of medications. The discrepancy button 250 is used by a user to indicate to the system that something requested was not provided, or that an indication previously input to the system is not accurate. Pressing the discrepancy button causes the display terminal to display a window appropriate to indicate the nature of the discrepancy. The patient usage browser window 244 also includes a previous page button 224 and a next-page button 226 similar to those previously described for scrolling through the information pertaining to the patient. Window 244 also includes a help button 240 and a close button 238 like those previously described. The close button is used when the user is finished with the patient usage browser window and wishes to return to the patient browser window 222.

Patient usage browser window 244 further includes a trade name/brand name button 252. Button 252 is operative to change the names of the medical items displayed on window 244 from the trade name to the brand name and vice versa. Button 252 may be toggled from one name for an item to the other. This feature is available in a number of windows and is useful for a user who may need to compare the brand name(s) of a medical item to the generic name and vice versa.

Trade name/brand name button 252 is enabled to provide this feature at the display terminal responsive to records stored in data store 85 in which the generic names and brand

69

names for medical items in the system are stored in correlated relationship. The data store 85 further includes in its records data indicative of whether each particular name for the medical item is the generic or brand name. Multiple brand names corresponding to generic names may be stored and displayed on the screen. This feature enables a user operating the display terminal to

5   toggle the display back and forth between brand name and generic name. In addition, the display terminal indicates in a header above the drug information whether the generic or brand name information is being provided on the screen. Button 252 changes to the opposite designation to that being displayed when it is toggled. This informs a user that they can change from, for example, the generic name shown in window 244 to the trade name or brand name by touching

10   button 252 on the touch screen.

From the patient browser window 244, a user is enabled to review medications available for dispense to a patient. To review the medications that have been prescribed for a particular patient, a user highlights the desired patient name by touching the name in the patient browser window 222 and touches a med order button 254. Touching med order button 254 causes a med

15   order browser window 256 shown in Figure 31 to be displayed. Med order browser window 256 includes information about the medical items that have been prescribed for the patient including information such as dosage and frequency of administration. The med order browser window also contains other information such as the route by which the medication is to be delivered to the patient such as orally or through intramuscular injection. The med order browser window

20   256 also includes the date and time information that the medication was started. If a medication has been stopped, this may also be indicated. It should be understood that the use of any medical

70

item for a patient may be referred to herein as "giving" the medical item to the patient regardless of how the medical item is used in the course of a patient's treatment.

If a user wishes to take a medication for a patient, the user may highlight the medication on the med order browser window and touch a dispense button 258. By touching the dispense

5   button on the touch screen, the display terminal is operative to cause the electronic lock drawer, medication dispenser or other apparatus in which the particular medication is held to operate to make the medication available to the user. The med order browser window 256 further includes an info button 260. Info button 260 may be pressed to display additional information about the particular medication which has been highlighted. This may include particular information that

10   the physician wished to include concerning the administration of the medication. Alternatively the information button may access information stored in the data store 85 concerning the particular medication itself including information such as possible side effects, drug interaction data and the like.

The med order browser window 256 further includes a trade name/brand name button 252

15   which may be used to change the displayed drug identification information from generic to brand name and vice versa. Window 256 also includes a help button 240, a previous-page button 224 and a next-page button 226, all of which function in the manner previously described. The med order browser window 256 further includes a close button 238 which a user may select to return to the patient browser window 222.

20   Instead of reviewing medications that have been specifically prescribed for a patient, a user from the patient browser window 222 may choose to dispense medications and medical items from a listing of all medical items which are available in the area adjacent the display

71

terminal. To accomplish this a user selects a supply button 262 on the patient browser window.

Selecting the supply button 262 causes a supply browser window 264 to open on the screen of

the display terminal. The supply browser window is shown in Figure 32. Supply browser

window 264 includes a listing of medical items which are available for dispense. A user may

5   select one of these substances by touching the screen adjacent to the item desired. If it is a

controlled substance such as a narcotic, the display terminal and associated computers are

programmed to require heightened security such as two authorized users to log on to the display

terminal before a dispense may be made as was previously discussed.

A user dispenses medical items from the supply browser window 264 by highlighting the

10   item desired and selecting the appropriate select quantity button 268. The select quantity button

indicates how many of one particular medical item the user desires to have dispensed. The user

then selects the dispensing button 258, which is operative to cause the display terminal to actuate

the appropriate device for dispensing the requested quantity of the item.

The supply browser window 264 also includes the trade name/brand name toggle button

15   252 previously discussed. The operation of button 252 is demonstrated with regard to an

alternative supply browser screen 270 which is shown in Figures 35 and 36. Alternative supply

browser screen shows only one medical item so as to make more apparent the operation of button

252. In Figure 35 button 252 is set to display the generic name of the medical item, in which

case the single medication shown is displayed by its generic name and button 252 indicates that it

20   is available to be toggled to the trade name. Toggling button 252 changes browser screen 270 to

the format shown in Figure 36 in which the trade or brand name of the medication is displayed,

and button 252 indicates that it is available to be toggled to display the generic name. Of course,

72

for medical items for which there is only a generic name, the data base records stored in the data store 85 in connection with computer 84 or other connected computer in the system may be arranged to indicate that there is no corresponding brand or generic name when this situation arises. Likewise for items which have multiple brand names, the display terminal is preferably

5   operative to provide all the brand names associated with the item.

The data store of the system also includes pricing information for both brand and generic medical items. The data terminal and connected computers are operative to charge the patient's account for the type of item which is dispensed. This is determined responsive to the name for the item displayed on the display terminal when the dispense is made.

10   In some situations the name type for an item prescribed for a patient may not be available in the dispensers connected to the display terminal or otherwise available in the area adjacent the display terminal. The display terminal or connected computer may be programmed responsive to a request to dispense an item by a trade or generic name which is not available, to indicate on the display terminal that the item is available under an alternative name. The user in response to

15   receiving such an indication, may toggle button 252 and dispense the item under its alternative name. In such situations, the user may also consider this a discrepancy which should be recorded in response to the user prompts generated in response to selecting the discrepancy button 250. The ability of the system to track items by both trade or brand names and generic names may avoid needless delay in providing medical items.

20   The supply browser window 264 also includes a physician/route/site button 272. Selecting button 272 causes a physician/route/site browser window 274 to be displayed. A sample physician/route/site browser window is shown in Figure 37. If there is already a

73

physician associated with the dispense of the medication selected in window 264 to the particular

patient shown in that window, then a physician button 276 will be highlighted in window 274. If

the physician button 276 is highlighted, then a user may press a route button 278 which will

cause the display terminal to display a further window which indicates the route that the

5   physician has prescribed for the medication to be administered to the patient. A site button 280

may be selected to review the site on the patient that the physician has prescribed for the

medication to be administered. If, however, when the user accesses window 274, the physician,

route or site buttons are not highlighted, no associations related to these parameters have been

made.

10   To associate a dispensing order with a physician, a user may select the physician button

276 to display a list of physicians on the screen. The user may then select a physician which

causes physician's name to be highlighted. The user may thereafter select the route button 278

which causes a listing of route information, as shown in Figure 37, to be displayed. The user

may then select a particular route by highlighting it. Thereafter, if appropriate, the user may

15   select site button 280, which causes a list of sites to appear. The user may select a site. To save

all the associated information that has been input, the user highlights an accept button 282. After

reviewing the information in window 274 or establishing a new relationship, a user may close

window 274 by selecting close button 238 and returning to patient browser window 222.

As previously discussed, a useful aspect of some embodiments of the present invention is

20   that medical items to be used for a particular medical procedure are stored in correlated relation

along with a designation of the particular medical procedure in the data store. These collections

of medical items are called "kits" in the preferred embodiment of the invention. Kits may be

74

established by the operator of the system in accordance with the particular needs of the system.

Kits may include particular collections of medical items for a particular procedure that is

scheduled for a patient. Alternatively and in addition, kits may also be a collection of medical

items used to conduct particular types of frequently-administered medical tests, such as

5   diagnostic tests.

      In accordance with an exemplary embodiment to the invention, from the patient browser

window 222 a user may review kit information by selecting a kit button 284. Selecting the kit

button causes a kit browser window 286 shown in Figure 33 to be displayed on the display

terminal. The kit browser window shows kits that have been prescribed for the selected patient.

10   In addition, the kit browser window preferably displays a listing of other available kits. A user

may select a particular kit by touching the kit on the touch screen. If the user wishes to learn

what items are in the highlighted kit, they may select a kit info button 287. Selecting the kit info

button causes the display terminal to display a kit information window 290 shown in Figure 34.

Kit information window 290 shows the name of the kit and all of the items that are included in

15   the kit. In addition the kit information window shows how many of the particular items in the kit

are available for dispense from the storage locations adjacent or attached to the display terminal.

The computer may alternatively be programmed either in the kit information window 290 or

when a kit is dispensed, to indicate to a user where items that are not available in the area

adjacent the display terminal may be obtained. The inventory tracking features of the invention

20   enable providing the user with the nearest location the needed item is stocked.

      After reviewing the information concerning what is in the kit, the user may select a close

button 238 on kit information window 290 to return to the kit supply browser window 286. The

75

user may select the dispense button 258 in window 286. Selecting the dispense button is operative to cause the display terminal to dispense or make available all the items in the kit together. In addition, the display terminal and connected computers may be programmed to indicate in response to selection of the dispense button that the user is required to manually take

5 from open storage certain medical items that may be required for the kit which are not dispensed. This is accomplished through appropriate programming of the records in the data store when the kit is established. Of course, selecting the dispense button 258 not only causes all of the items in the kit to be dispensed or otherwise made available, but such items are also charged to the patient's account.

10 The storage of information in the data store concerning kits, which is data representative of collections of items stored in correlated relation for a particular procedure or activity, is highly useful. It provides for automatically dispensing the needed items together where possible, and provides a visual reminder to the user of the system of all the things that are needed to accomplish a particular medical procedure. This avoids mistakes and saves time. Of course,

15 after reviewing the kit browser window 246 and/or dispensing a kit, a user may return to the patient browser window 222 by selecting the close button 238.

After a user has completed dispensing transactions for a particular patient, they may take medications for another patient by highlighting that patient on the patient browser window 222 and repeating the steps for that patient in accordance with the procedures previously discussed.

20 The system is programmed so that a user is free to obtain items either from dispensers of various types in response to dispensing requests, to manually remove items from hook or box register locations or to take items from accessible storage locations. For those items which are controlled

76

substances such as narcotics, dispensing transactions cannot be completed until a second

appropriate user or witness enters their identifying information to the system to witness the

dispensing transaction. As previously discussed, dispensing transactions which are conducted by

a user or a witness are recorded by storing the information on what was dispensed in correlated

5   relation with the user's record as well as with the patient's record in the data store. Of course, the

system may be programmed to correlate and store other types of information as well.

When a user is finished with dispensing medications for patients, they may select the

log-out button 232 at which point the display terminal waits to be accessed by another authorized

user.

10   It should be noted that the patient browser window 222 also includes a restock button 292

and a retrieve button 294. The restock button 292 is used in connection with restocking the

system. Certain system users have correlated records in the data store that enable them to restock

the system. Such a user, when they access the data terminal may also select the restock button

292 and cause the display terminal to display windows upon which a user may indicate which

15   items have been restocked, and the available quantities. The person restocking preferably does

this by accessing the dispensers and electronic lock drawers using keys or access methods which

are not controlled through the display terminal. However, in other embodiments the display

terminal may be used for opening the dispensers and electronic lock drawers for restocking

purposes as well. Once the user restocking the items has completed the information associated

20   with the restocking activity, they can log out of the display terminal by selecting button 232.

Retrieve button 294 is likewise used by a selected group of authorized users. The retrieve

button is used to enable certain selected users who have authority to access medications that have

77

been returned or wasted and which are stored in a particular retrieve drawer. Such an authorized

user has an associated record in the data store that authorizes them to do this and when such a

user authorizes the system and selects this button, the retrieve drawers may be opened. To enable

the user to retrieve such items, the process of retrieving returned or wasted medications is

5   described in U.S. Patent Nos. 5,957,372 and 5,961,036, the disclosures of which are incorporated

herein by reference. Again, after a user has conducted a retrieve activity, they may exit from the

system by selecting the log-out button 232.

Embodiments may also be used in connection with medical items which are

"non-itemized". Such items are generally not counted and not tracked to patients so there is no

10   record maintained in the data store that such an item was taken for a particular patient. Likewise,

in most cases the item is not billed to the patient. However, in some cases items may be tracked

to a patient but not billed. Generally non-itemized items are stored in open storage locations.

Any authorized person is free to take these items for patients or for a medical condition that the

user may be experiencing.

15   It is important however that supplies of non-itemized or otherwise uncounted medical

items be maintained at adequate levels. Because the system does not track the taking of such

items it is possible for such items to fall below desired levels or to be completely depleted before

an appropriate person is notified to replenish the quantity of medical items in the non-itemized

storage location. Significant time periods may elapse before the supply is replenished.

20   An embodiment of the present invention operates to minimize the risk that non-itemized

medical items will be depleted. This embodiment enables a user, upon noticing that the level of

items in storage in a storage location has fallen below a desired level, to indicate to the system

78

this condition. An appropriate function within the medical facility is notified and the storage

location is restocked. To achieve these results storage locations for non-itemized medical items

are physically marked to indicate a level at which restocking should be performed. Generally this

may be accomplished by placing a physical marking in the storage location, such as a line on a

5   shelf. As items are removed from the shelf for example from left to right, a user knows that

when the number of items remaining is "below the line" there is a need to indicate this quantity

condition to the system. This level in some instances may be referred to as a "minimum"

acceptable level of supplies. Alternatively, the level may be referred to as a "par value" which

means the average desirable quantity of medical items to have available. Where the levels are set

10   and how they are characterized depends on the medical item and the needs of the users of the

system.

As shown in Figure 38 a user approaching the display terminal is presented with the user

log-in screen 302. In the embodiment of the invention shown the user may press the

"non-itemized button" 304 without logging into the system. When the user presses the

15   non-itemized button the non-itemized inventory window 306 shown in Figure 39 is presented on

the screen of the display terminal. Non-itemized inventory window 306 presents a listing of the

non-itemized inventory items as well as their locations.

The user, after accessing the non-itemized inventory window, may highlight a particular

supply by touching the touch screen in the area where the item is listed. The user may indicate

20   the particular quantity condition that the user has noted for the supply. For example, if the

supply is below the desired level the user may touch the "below minimum button" 308 on the

touch screen. Pressing this button causes a signal to be generated and a message to be

79

transmitted to the data store that the items in this particular storage location are below the minimum. The system is preferably programmed so that this information is also presented in the form of a message or report to the function or department in the medical facility responsible for restocking the storage location. In response a restocking of the particular storage location with the corresponding items is performed. Similarly if a user notes that a particular supply position is out of stock, the user may press the "out of stock button" 310 on the non-itemized inventory window 306. Pressing the out of stock button causes a different signal to be generated and transmitted to the data store, as well as to the restocking function. Preferably the system is programmed so that the restocking function is notified on a more urgent basis to replenish the items in the storage location than in the case of a below minimum situation. When the user is done using the non-itemized supply window they may return to the user log-in screen 302 by pressing the "close button" 312.

As shown in Figure 39 the non-itemized inventory window 306 also includes a "trade/brand name button" 314 which may be used to change the supplies from brand to generic name and vice versa responsive to pressing the button. Likewise, a "position/name button" 316 is provided so that the window 306 can present the non-itemized medical items either in order by name or by supply position. This facilitates finding a desired item quickly.

The system of this embodiment is preferably operable to determine the locations where supplies need to be replenished and to provide the users who perform the restocking function with information on the types of medical items and the quantities which must be added to the storage locations. In the case of non-itemized inventory a restocking user who has replenished a storage location by adding a quantity of medical items thereto, may highlight the particular item

80

and location and indicate that it has been restocked by pressing a "restock button" 318. Often the restocking function will replenish all of the storage locations. When this is done the restocking user may indicate that all the non-itemized locations have been restocked by pressing a "maximum all button" 320. The use of this feature saves considerable time for a restocker who would otherwise be required to highlight the various items either individually or in groups and change their status.

In an alternative embodiment to the invention, the actuation of the restocked button 318 and the maximum all button 320 may be limited to users who are authorized to carry out a restocking function as indicated by the data in the data store. In a system configured to be operated in this manner, a restocking user would be required to log onto the system using the user log-in screen 302, as must be done for inventory that is itemized and tracked to patients. Once the user with restock privileges has logged in, the appropriate buttons may be touched to indicate that the quantity conditions at the storage locations have been changed.

The operation of the described embodiment of the system for handling non-itemized medical items provides a significant time savings for system users. Handling items as non-itemized is particularly appropriate for common, low cost items which are often accessed and are not billed to patients. Implementing this approach avoids the need for users to go through additional and unneeded steps to take such items. Of course, if the institution operating the system decides that items in non-itemized inventory should be tracked to patients, counted or billed, such items may be reclassified in the data store. The result would be that such items would be removed from the non-itemized inventory listing and included in the listing in the

supply browser window 264 and other appropriate windows which show medications which are tracked and billed.

A further alternative embodiment of the system for tracking and dispensing medical items is shown in Figure 40. This alternative system generally indicated 322 is similar to the system described with reference to Figure 13, except as otherwise indicated. The system 322 includes a computer 324 which includes therein or is otherwise operatively connected to a data store, schematically indicated 326. It should be understood that computer 324 and data store 326 are shown schematically and that embodiments of the invention may consist of several operatively connected computers and data stores.

The computer 324 is connected through a network 328 to other devices and systems. Network 328 may be a local area network (LAN) within the facility, or wide area network. Network 328, as in the previously described embodiment, is connected to the facility's admission, discharge and transfer (ADT) system schematically indicated 330. Likewise, network 328 is connected to the facility's information system (HIS) 332 and the facility's pharmacy system 334. Preferably, as in the previously described embodiment, all of these systems within the facility are enabled to exchange information and function in cooperation with other devices connected through the network 328.

System 322 also includes one or more administrator's workstations 336. The administrator's workstations are similar to those in the previously described embodiment of the system. The system also includes a plurality of display terminals 338, only one of which is shown. Display terminal 338 is similar to the display terminals 98, 76 and 102 previously described, except as otherwise indicated. Display terminal 338 includes a touch screen 340

which serves as an input device and an output device. The display terminal also has a fold down, alphanumeric keyboard 342 which serves as an input device. Display terminal 338 also preferably includes a card reader, a processor, as well as its own local data store, and interfaces connecting the display terminal to both the network 328 and the other devices to which it is

5   connected.

The display terminal 338 is in operative connection with storage devices for storing medical items. An electronic lock drawer 344 is connected to the display terminal 338. Electronic lock drawer 344 is similar to the electronic lock drawer previously described, except as otherwise indicated. The electronic lock drawer includes a plurality of storage locations for

10   medical items and includes electrically actuated locks for selectively controlling access to the storage locations. The locks are opened in·response to signals sent from the display terminal 338.

A refrigerator 527 is also connected to display terminal 338. Refrigerator 527 includes a lock module thereon and operates in a manner similar to the refrigerator 450 previously

15   described. The refrigerator has an interior area which includes one or more storage locations for storing medical items therein. A lock module on the refrigerator selectively controls access to the interior area of the refrigerator in response to one or more signals sent from the display terminal 338.

A dispenser 346 is also connected to display terminal 338. Dispenser 346 holds a

20   plurality of different types of medical items in storage locations therein, and selectively dispenses medical items from its storage location in response to signals from the display terminal 338.

Dispenser 346 may be similar to dispenser 100 or preferably may be a dispenser of the type

shown in U.S. Patent No. 6,019,249, the disclosure of which is incorporated herein by reference.

The alternative system 322 further includes a reading device 348 in operative connection

with the display terminal 338. The reading device 348 is preferably a device for reading machine

5   readable indicia such as bar code. The reader device further preferably includes a display screen

or other output device 350, as well as an input device 352 in the form of a keypad with

alphanumeric designators and function buttons, through which a user may enter inputs.

An exemplary form of the reading device 348 includes its own internal processor and

memory. The memory includes programmed instructions referred to herein as configuration

10   data, which controls the operation of the processor and the components which make up the

reading device. The configuration data includes data which enables the reading device to

recognize and interpret machine readable indicia. It also preferably includes information on

authorized users of the system and their corresponding personal identification numbers (PIN).

The configuration data preferably further includes information on storage locations and the

15   location designators for locations associated with the display terminal 338, as well as the medical

items stored in those locations. The configuration data also preferably enables the reading device

to receive instructions and to generate transaction messages. The transaction messages are sent

to the display terminal, and are then forwarded to the other components of the system. The

reading device 348 also preferably includes a storage location or cradle schematically indicated

20   354. The cradle 354 provides a place for holding the reading device when it is not in use. In

addition, placement of the reading device in the cradle may be used to initiate certain activities by

the reading device as hereinafter explained.

84

This alternative form of the system of the invention is described in connection with Figure 40. Storage locations are preferably labeled with machine readable indicia corresponding to the location designator established in the data store for the particular storage location. Such machine readable indicia identifies the location and also preferably the medical item type to be

5   stored in the location. As will be appreciated from the description of the operation of the system which follows, including machine readable indicia representative of the medical item type enables the system to verify the data in its data store concerning the type medical item stored in a storage location. This feature may also avoid the need for the data store to include information on the medical item types stored in certain storage locations, because such information can be

10   read directly. Alternatively, storage locations may be labeled only with indicia representative of the location or the medical item, and the data stored in the data store can be used by a processor to resolve the corresponding medical item or location.

A schematic view of an open storage shelf indicated 356 is shown in Figure 40. Shelf 356 holds medical items thereon which may be removed by a user of the system. Shelf 356

15   includes machine readable indicia 358 thereon which identifies the particular storage location. The indicia may also include data representative of the medical item type stored therein.

Preferably the machine readable indicia also includes human readable indicia to advise a user what is stored in the storage location. This is preferably done using a label, an example of which is indicated by label 360 shown in Figure 41. Label 360 is an example of a position only

20   label which includes machine readable indicia which indicates only the storage location and the medical item stored therein. Label 360 is an example of the type of machine readable indicia used on storage shelf 356 and indicated by machine readable indicia 358 thereon.

Further machine readable indicia are also applied to the storage locations in this alternative embodiment of the invention. Such further indicia is explained with reference to storage shelf 362 shown in Figure 40. Storage shelf 362 includes machine readable indicia 364 which like indicia 358, identifies the storage location. It should be noted that indicia 364 is positioned so as to be accessible only when the medical items stored on shelf 362 have been reduced to a level such as the below par value or below minimum, where restocking is desirable. Of course storage shelf 362 may be marked in an appropriate manner as shown to indicate when the quantity of medical items stored thereon has fallen to a level where an input should be given to the system to replenish the location. Storage shelf 362 also includes further machine readable indicia 366. Further indicia 366 is preferably positioned to become accessible when the last of the medical items stored on the shelf is removed. In alternative embodiments further indicia 366 may be placed in other locations however.

Figure 42 shows a label 368 which is used to indicate an out of stock condition at a storage location. Label 368 corresponds to indicia 366 shown in Figure 40 on storage shelf 362. Label 366 indicates the storage location as well as the item stored therein, as well as the quantity condition that the item is out of stock at that location.

As further shown in Figure 40, storage shelf 362 includes further machine readable indicia 370 thereon. Such machine readable indicia 370 is preferably used by a user restocking the shelf 362 to provide an input that the particular medical item type stored in the location has been restocked. Figure 43 shows an example of a label with indicia which indicates that a particular storage location has been restocked with a medical item. Such labels are preferably

positioned in locations which are inconspicuous, and which can be read with the reading device 348 when the storage location has been restocked.

It should be understood that storage shelves 356 and 362 are shown as shelves for storage of non-itemized inventory. Because non-itemized inventory items are not tracked to patients, there is a need in some embodiments of the invention to distinguish such inventory from other open shelf type inventory that may need to be tracked. It is therefore preferable to provide visually distinguishable characteristics for labels or other machine readable indicia used for non-itemized inventory to distinguish them from indicia used in connection with medical items which must be tracked. One manner of accomplishing this is to use different colored labels for itemized and non-itemized inventory.

For itemized inventory for which each unit is counted and/or tracked, it is desirable to provide separate machine readable indicia which can be used to indicate that a particular storage location is exhibiting a quantity condition corresponding to a level requiring replenishment, but has not yet reached the level of being totally depleted. To accomplish this for itemized medical items, machine readable indicia which indicates the "below minimum" or "below par value" quantity condition are placed adjacent to the storage locations. An example of such a label used for accomplishing this function is indicated 374 in Figure 44.

It should be understood that while the foregoing description discusses holding non-itemized inventory in open shelf locations, in other embodiments of the invention non-itemized inventory may be held within enclosures or other containers. Such areas may include cabinets with shelves for holding such items as well as environmentally controlled

chambers including refrigerators, high temperature chambers, low humidity chambers and other types of containers where medical items may be stored prior to use.

In the alternative form of the invention described with reference to Figure 40, certain storage locations are controlled by an access control device such as the locks of an electronic

5   lock drawer or refrigerator. Storage locations are also marked with machine readable indicia of the type previously described. Figure 45 shows an example of a single drawer 376, within electronic lock drawer unit 344. Drawer 376 includes a storage location 378 for storing medical items therein. As shown in Figure 45, the storage location includes machine readable indicia in the form of a label 380, which indicates the location designator for the storage location as well as

10   the medical item type stored therein. Storage location 378 further includes further machine readable indicia in the form of a label 382, which is an out of stock label. As shown in Figure 45, the out of stock label 382 is positioned on the bottom surface of the storage location, so that it becomes accessible when all the items have been removed.

It should be understood that for storage locations which hold medical items which are

15   counted and/or tracked by unit, the computer may calculate, and the data store may include, data representative of the number of units remaining in each storage location. However, it is also possible to include among or on the units of medical items machine readable indicia, which can be used to indicate that the number of medical items in the storage location has fallen to a level where restocking is required. Such indicia may be on the item which the user can scan when the

20   item is taken. Alternatively, the indicia may be on a card or other divider placed between the medical items. In either case when the indicia is scanned the system is apprised of the number of units remaining at the location.

In the alternative form of the invention not only are each of the storage locations marked with machine readable indicia, but the access control devices themselves, such as the electronic lock drawer or refrigerator, are marked with unique indicia. In the case of electronic lock drawer 344 this may include labeling the entire electronic lock drawer unit with a single machine

5   readable indicia. Alternatively, it may include labeling each drawer (or storage location within a drawer or other interior area) in the electronic drawer unit with such indicia. This indicia may be used in a manner later explained to selectively open the electronic lock drawer unit. Of course a similar approach may be taken with refrigerator or other devices which house medical items.

       The alternative form in the system 322 shown in Figure 40 includes a report generating
10   means which is schematically indicated by a printer 384. Printer 384 may be positioned at a nursing station, restocking staging station or other location that is convenient for users of the system. It should be understood that while only one printer is shown, additional printers or other types of report generating means may be included in the system. The printer 384 is in operative connection with a computer 386. Computer 386 operates in accordance with programmed
15   instructions and includes an internal memory or data store therein. Computer 386 is in operative connection with the network 328.

       The printer 384 is operative responsive to the programmed instructions stored in connection with the computer 386 to generate reports schematically indicated 388. The reports produced by the report generating means preferably include both human readable indicia as well

20   as machine readable indicia. As later discussed in detail, reports which include such indicia may be produced for use in dispensing medications as well as for restocking the storage locations of the system.

In the alternative form of the invention, storage locations may be labeled with other types

of machine readable indicia. Such indicia are recognized by the reader in accordance with its

configuration. In certain embodiments "prefix" labels or similar indicia may be applied. Such

prefix labels indicate a particular quantity condition. The prefix labels indicate the quantity

5   condition exists at the location corresponding to the next location indicia read. In the preferred

form of the invention the quantity condition associated with the prefix label takes precedence

over any quantity condition associated with the next label that is read, provided the next label is

read within a set time which is established in the reader configuration.

For example, a single prefix label indicating a "restocked" quantity condition may be

10   placed adjacent to several storage locations. A restocking user may indicate that he or she is

filling an empty storage location by reading the "restocked" prefix label, and then reading the

"out of stock" label or "below par" label at the location within the set time. Because the prefix

takes precedence over other quantity conditions, the other quantity condition in the label is

disregarded and the reader stores data which indicates that the particular storage location has

15   been restocked.

Other types of prefix labels indicating other types of quantity conditions may be placed

adjacent to storage locations and used in a similar manner. Such other prefix labels may be

associated with quantity conditions such as "below par", "out", "out of stock, emergency

restocking needed", "one unit taken" or other quantity conditions. Reading a prefix label

20   indicates the quantity condition for the next label read which includes a location identifier

(provided it is read within the set time) regardless if there is a different quantity condition

indicated on the label that includes the location identification data.

In the alternative form of the system the configuration of the reader determines a quantity condition being indicated based on a hierarchy. A quantity condition indicated by a prefix label is at the top of this hierarchy. Thus, prefix label data when read takes precedence over any other quantity condition that may be included in indicia subsequently read by the reading device or established through the configuration of the reading device.

The second tier in this hierarchy is preferably the "out" quantity condition. Thus, if a different quantity condition is established by the configuration of the reader, and a label indicating an "out" condition at a storage location is read, the reader configuration will interpret this as an "out" indication at that location. However, if a prefix label had been read first, the quantity condition associated with the prefix label would be indicated because prefix labels are higher in the hierarchy.

As later explained, the reader includes data representative of authorized users. The data representative of certain authorized users has stored in correlated relation therewith a quantity condition that the user normally reports or performs. For example, if a user normally takes medications for patients, the quantity condition associated with that user data would be "one taken". As a result, when that user is "signed on" the reader, and reads a label which includes location indicia, the configuration of the reader will interpret the reading of the location indicia as indicating the "one taken" quantity condition at that location. This would be true unless a "prefix" or "out" label had been scanned.

As later discussed, users may have various quantity conditions associated with them. In addition to "one taken" for users who normally take items, restocking users may have the "restocked" quantity condition associated with their identifying data. Other types of quantity

91

conditions can be assigned to particular users who normally perform the act or function associated with their associated quantity condition.

The configuration of the reader preferably provides a time period for a user who has identified himself or herself as operating the reading device, to begin reading location indicia where the quantity condition associated with the user has occurred. If the reader "times out" without location data being read, the next read location will not be treated as having the quantity condition associated with the particular user.

The lowest level in the hierarchy is one where no user with an associated quantity condition has indicated that he or she is operating the reader, and no "out" or "prefix" label has been read. At this lowest or default level, the configuration of the reader interprets the reading of indicia which includes a quantity condition and location as the condition existing at the location. If the indicia does not include a quantity condition, and only location data is read, the configuration of the reader interprets that as a "below par" quantity condition at the particular location. This is done provided the location is one where the medical items are not counted as indicated by the system configuration. If the location indicia read is of an improper type such as in a dispenser where "below par" is not appropriate, the configuration causes an "error" signal indication to be given. Such error indications are also given when any operation of the reading device is attempted which is incompatible with the configuration of the reader.

In operation of the alternative system shown in Figure 40, the reading device 348 is operated by users of the system to accomplish dispensing and restocking activities. In a first form of this alternative embodiment the reading device is operated to perform activities comparable to those previously described as accomplished using the display terminal. The

92

reading device includes the screen 350 which serves as an output device, as well as input devices 352, which enable it to be operated in a manner similar to the display terminal 338. As previously discussed, the reading device 348 includes a processor and a memory which enables it to operate independently of the processor and memory of the display terminal. In this form of the

5   invention the reading device is a bar code scanner, Model PDT 3100 made by Symbol Technologies. Of course in other embodiments, other reading devices such as personal digital assistants, portable or hand-held terminals or similar devices may be used.

The reading device may be connected to the system by a data line as shown. Alternatively, the reading device may connect to the system by wireless communication methods,

10   such as IR or RF. Other wireless connection methods such as inductive or capacitance coupling approaches may alternatively be used, as well as periodic electrical coupling or other physical connection techniques.

In a first mode of operation, the reading device operates in accordance with the logic flow shown in Figures 47-49. As previously discussed, all authorized users of the system are

15   preferably provided with badges, identification cards, identifying articles or have distinguishing features which include machine readable indicia identifying them as authorized users of the system. The memory in the reading device 348 is configured to hold information concerning the indicia associated with authorized users. It is also preferably configured to store and hold each user's personal identification number (PIN) uniquely associated with the user. The reading

20   device also holds the particular quantity condition function data, such as dispensing or restocking, which certain users are associated with. All of this information is established in the data store 326 in the course of setting up the system and in the exemplary embodiment is down

93

loaded into the configuration of the reading device 348 through an interface which resides in the display terminal 338. The reading device 348 is configured so that it defaults to providing a "below minimum" quantity condition message in the event that no other quantity condition is specified. The reading device 348 is also configured to produce transaction messages as well as

5   other messages which are sent to other components of the system. These include messages which update the information stored in the data store 326.

The logic flow for the reading device begins as represented in Figure 47. A user wishing to operate the system through the reading device 348 begins with the processor executing a process 390 in response to a user scanning a machine readable indicia, which for purposes of this

10   example will be a bar code. The bar code scanned may be indicative of a particular supply storage location. If such location indicia is scanned without first scanning indicia which identifies a user, the hierarchy in the configuration of the reading device previously described interprets the activity as indicating that the medical items stored in the position scanned are "below minimum". In response, the reading device 348 generates a transaction message which

15   indicates that the medical items in the storage location have this quantity condition.

Alternatively, a user may find that a particular storage location is out of stock. In response to observing this quantity condition, the user may scan the bar code label similar to that shown in Figure 42. In response to scanning such a bar code process 390 causes a transaction message to be generated which indicates the out of stock quantity condition at the particular

20   storage location. In accordance with the hierarchy in the configuration data, the "out" quantity condition is indicated when this label is scanned, regardless of whether the user is logged on and whether the user is associated in the data store with a particular quantity condition.

94

Alternatively a user may indicate a below minimum or out of stock condition by scanning the out of stock bar code at a storage location which will cause similar transaction messages to be generated. Storage locations may be provided with "below minimum" labels similar to those shown in Figure 44 so that a user may indicate the below minimum quantity condition by

5   scanning this label, without having to log on the system. Alternatively, if a user who normally takes medications is logged on the system, a "below minimum" condition at a location can be indicated by scanning a "below minimum" prefix label and then any label which includes the location indicia for the location where the below minimum quantity condition exists.

Enabling a user to scan the bar code labels which are representative of the below

10   minimum and out of stock quantity conditions is a time saving feature. This is particularly true when the user is indicating such conditions for non-itemized inventory. In such circumstances the user is not required to log into the system, but nevertheless can indicate these conditions so that persons with the responsibility for restocking the storage locations may be notified.

As indicated in process 390, if a user wishes to log onto the system using the reading

15   device they may first scan the bar code or other machine readable indicia on their badge, identification card, etc., using the reading device. In response to the user scanning a proper badge, identification card, or other item, the processor in the reading device proceeds to the next process in the logic flow, process 392. Of course as indicated in process 390, if any bar code other than an appropriate bar code is scanned, an error signal is generated, an error indication is

20   presented on the screen and the reading device returns to process 390 in the logic flow to wait for further input.

In process 392 a user is prompted through the screen 350 on the reading device to input their PIN. A user can do this through the keypad which is part of the input device 352. The configuration of the reader provides a predetermined time after scanning the badge or identification card for a user to input their PIN. If this input is not accomplished within the set time, the logic flow returns to process 390. Similarly a user may return to process 390 by pressing a "cancel" key on the input device 352 or by sending a log out message. In the exemplary form of the invention the log out message is generated by scanning a particular bar code which is conveniently placed for this purpose. In addition, or in the alternative, the reading device may be programmed to generate a log out message when it is returned to its cradle 354.

If a user proceeds to enter a PIN number within the time period provided, the reading device 348 checks the PIN against the data stored in its memory. If the PIN is verified as correct the configuration changes the operation of the reading device so that the subsequent scanning of position bar codes is taken to represent the particular quantity condition function which is associated with the user. As a result, if the stored configuration data indicates that the user normally dispenses medications, the subsequent scanning of a position bar code will be interpreted as a dispense of that medical item (a "one taken" quantity condition). Likewise, if the stored data indicates that a user is normally involved with restocking activities, the subsequent scanning of a location bar code will be taken as a restocking event. Of course other types of quantity condition functions (or a no quantity condition function) may be associated with particular users.

In the alternative form of the invention the report generating device, which is printer 384, generates reports. The report generating device preferably produces reports which include the

96

names of patients who may receive medical items as well as indicia, such as bar code, which

corresponds to each patient. In the preferred form of the invention, the reports further include the

medical items that have been prescribed for the patients as well as machine readable indicia

representative thereof. This information is based on the information stored in the data store.

5   Preferably the reports are limited to patients in the rooms which have been designated through

the programming of the system as associated with the particular display terminal to which the

reading device 348 is attached. In this embodiment a computer program called "The Bar Tender"

commercially available from Seagull Scientific Systems is used for generating bar code indicia.

Of course, in other embodiments other programs may be used for producing the text and indicia

10   which comprise reports.

       In the alternative form of the invention, a patient may be selected using the reading device

348 by scanning the bar code associated with the particular patient printed on the report. The

user is preferably prompted to do this as the configuration logic executes process 394, as shown

in Figure 47. If the user scans a patient bar code, a timer built into the configuration of the

15   reading device waits a time for the user to scan a position bar code. The user may accomplish

this by scanning the position only bar code similar to the one shown in Figure 41, if the medical

item to be taken is stored in an open storage location. If such a bar code is scanned a transaction

message will be generated that such item was taken by the user for the indicated patient. The

user may indicate that several of the same items were taken by scanning the bar code a number of

20   times corresponding to what was taken. Similarly, the user may scan several different locations

to indicate the different items taken for the patient.

If the medical items which are needed for the patient as indicated in the report 388 include items positioned in an electronic lock drawer 344, the user may scan the bar code on the electronic lock drawer. If the data stored in the data store 326 concerning the user indicates that they have authority to access the electronic lock drawer, such information will be included in the configuration data for the reading device. As a result, when the user scans the bar code associated with the electronic lock drawer, the access control system which controls opening the drawers, will open and make the medical items therein accessible. The user may then open the drawers where the medications are needed and may indicate the taking of medical items for the patient by scanning the position labels for the storage locations holding the medications, such as label 380 shown in Figure 45. This generates a transaction message indicating that the medical items stored in the storage locations for which the labels have been scanned have been taken for the designated patient.

In alternative forms of the invention, each of the drawers in an electronic lock drawer unit may be labeled with machine readable indicia which enables the access control device to provide access to each drawer individually. Likewise, the reading device 348 may be configured to provide access for users to the drawers selectively. This may be desirable when drawers of the electronic lock drawer unit 344 contain medical items which are only to be accessed by certain personnel, or which require two authorized users to log-in in order to access the medical items in a particular drawer. As will be appreciated from the previous discussion concerning the display terminal, the reading device 348 may be configured to require two authorized users to log in to achieve the dispense of a selected medical item such as narcotics, in a manner comparable to that done using the display terminal.

It should be appreciated that while the process of using the reading device in connection with electronic drawer devices has been described, similar processes may be used in connection with other devices which hold medical items. These include refrigerators such as refrigerator 527, cabinets and various other types of units which include storage locations for medical items.

After a user has scanned the bar code at the storage locations from which medical items have been taken for the indicated patient, the user may log off the system as indicated in process 394 which returns the processor to process 390. Alternatively, the user may scan the indicia corresponding to another patient and may scan the storage locations for the medical items taken for that patient in the manner previously described. The user may take medical items for a number of patients before logging off the system. The configuration within the scanner causes transaction messages to be generated which include information about the dispense events. Such transaction messages preferably include data representative of the patient, the medical item and its storage location, the user of the system taking the item, as well as the time and date information that the item was taken. Of course the transaction messages also include data representative of the quantity condition which the transaction message represents. In the case of a dispense quantity condition, the transaction message includes a quantity condition indication which includes data representative of a dispense. This indication distinguishes it from transaction messages which indicate other quantity conditions such as below minimum, out of stock or restocked. The processor and the configuration in memory in the reading device serve as a quantity condition indicating device which operates to generate the quantity condition indication which is included in the transaction messages.

As shown with reference to the logic flow associated with process 394, if an improper scanning operation is performed, the logic returns the system to an appropriate process. The configuration of the reading device is also set up to provide the user with appropriate textual prompts. For example, the configuration of the reading device causes the system to consider the next transaction to be a dispense due to data stored for a user who has logged on the system. However, rather than indicia associated with a patient being scanned next, a bar code associated with a storage location is scanned. In this case the logic in process 396 is executed by the processor in the reading device. Process 396 directs the logic flow to the appropriate process based on a sequence of inputs made. Further as shown with regard to process 394, a user operating the reading device is free at any time to scan the bar codes to indicate a below minimum or an out of stock quantity condition at a storage location, which causes a transaction message to be generated corresponding to the condition which is read.

Alternative embodiments of the invention may operate dispensing devices, such as dispenser 346, or enable access to storage locations which are controlled by access control devices, such as lock drawer unit 344, or refrigerator 527, in response to indicia which corresponds to the medical items prescribed for patients printed on the reports. The reading device 348 is preferably configured to include data representative of the storage locations within the dispenser and other devices. A user wishing to dispense a medication from a dispenser, rather than scanning a storage location or an electronic lock drawer unit, may scan the indicia corresponding to the medication desired from the report. In response, the reading device causes the medical item to be dispensed from its storage location in the dispenser, if that is where the item is found. Similarly, if the medical item corresponding to the scanned indicia is stored in the

100

electronic lock drawer or the interior area of the refrigerator, the access control device will enable

the drawer or refrigerator holding the item to be accessed by the user.

The ability to dispense and access medications based on the machine readable indicia

from the reports further increases the speed at which items may be dispensed and the information

5   recorded for eventual storage in the appropriate data store of the system. Further, in this

alternative form of dispensing medications, a confirmatory step may be required by the

configuration of the reading device so as to provide an indication that the requested item was in

fact dispensed or taken. This may include for example the user providing an input through the

keypad, which is part of the input device 352 of the reading device, or alternatively scanning

10   machine readable indicia on the dispenser, or on their identification card or badge. Such

functionality may be readily included with the logic which is part of process 394.

The various signals which have been scanned or otherwise input into the reading device

348 are used to generate the transaction messages. This may be done as data is being read or is

preferably done after the user logs off the reading device. The transaction messages are

standardized within the system and are generated in accordance with the configuration data

15   stored in the reading device. The transaction messages are preferably dispatched in a batch mode

after the user logs off to avoid slowing the user down waiting for messages to be transmitted to

other parts of the system. When the user logs off the transaction messages are sent through the

interface in the display terminal 338 and into the network 328 from which they are received by

20   computer 324 or other computers connected to the system. The transaction messages are used to

include information about the quantity conditions and other events which have been carried out,

in the data store 326. Of course it should be understood that the transaction messages may be

101

sent to a number of different computers and modify data in numerous data stores depending on the programming of the particular system.

In this embodiment of the invention, after the transaction messages have been sent by the reading device 348 to other parts of the system, the computer 324 is operative to down load current configuration data into the reading device. This assures that the most current information is configured in the reading device.

In the operation of the alternative version of the invention, the transaction messages received by computer 324 may be indicative of a need to replenish the supplies of medical items at certain storage locations. This is true regardless of whether the transaction messages are generated based on inputs to the reading device or to the display terminal. In response to such conditions being indicated, computer 324 in cooperation with computer 386 or other similar computers positioned elsewhere in the system and connected through the network 328, is operative to cause a report generating device such as printer 384 to print a report concerning the storage locations needing to be restocked. Preferably the report includes information concerning the storage locations requiring restocking, the medical items stored therein, and the quantities of such medical items that are needed. The report preferably includes this information both in human readable and in machine readable form.

A person who is to restock the storage locations for which the report is printed may use the reading device 348 to facilitate the input to the system of restocking information. The restocking function is further demonstrated with reference to the logic flow processes shown in Figure 48. A restocking user who logs into the system does so in the manner previously described with regard to a user who conducts dispensing activities. However, such a restocking

102

user will have data stored in the configuration of the reading device which indicates that they perform a restocking function. From the process 394, with a restocking user logged on, the user preferably scans the bar code corresponding to a particular storage location to be restocked. An example of restock order bar code found in a restock report is indicated 398 in Figure 46.

Upon scanning the restock order bar code on the restock report, the logic executed by the processor in the reading device next moves to process 400. In process 400 the user scans the bar code for the storage location being restocked. This may be the bar code corresponding to an open storage location, a location in an electronic lock drawer, a location in the interior area of a refrigerator or a location in the interior of a dispenser. The reading device 348 is preferably configured to prompt the restocking user to scan the position only bar code. After the position bar code has been scanned the logic next moves to process 402 in which a user enters the quantity of medical items currently stored in the position. This is done by the user counting the items and using the numeric keys in the input device 352 of the reading device. The user is preferably prompted to do this on the screen 350 by the configuration of the reading device. The requirement to input existing quantities is only carried out for medical items which are itemized and counted. For non-itemized items where absolute quantities are not a concern, the reading device is preferably configured to enable a user to avoid the input of current position quantities.

The current position quantity information is useful for counted and itemized inventory items as it can be compared to information stored in the data store 326 to verify that dispense events have been properly recorded. If a discrepancy has occurred, the computer 324 is preferably programmed to provide an indication thereof at the administrator's workstation 336 or at another appropriate output device in the system.

103

After a user has input the current position quantity at process 402, the logic next moves to

process 404 in which the user enters the quantity which is being restocked in the storage location.

The user is preferably prompted to do this by prompts presented on the display 350. Of course as

indicated in processes 400, 402 and 404, if a user makes an error in the sequence of scanning or

5   inputting, indicates that they wish to cancel the transaction, or the timers included in the

configuration time out without receiving the next required input, the logic returns to an

appropriate process.

It should also be noted in Figure 48 that a restocking user is also enabled to restock

without using the restock order bar code on a restocking report. As indicated in the logic flow a

10   user who has restock rights is enabled to move from process 394 to process 402 by scanning the

position on the storage location to be restocked.

Of course restocking operations cause the reading device to generate signals which are

indicative of the quantity condition associated with a position being restocked. The reading

device is operative based on its configuration to build transaction messages corresponding to the

15   restocking activities at the various storage locations. These transaction messages include data

representative of the user performing the restocking activity, the storage location, the medical

item involved, as well as the time and date of the activity. Again these transaction messages

may not be transmitted to the other components of the system until after the user logs off the

system. This assures that the restocking user may perform their operations at the fastest possible

20   rate.

Figure 49 shows the logic flow associated with the generation of transaction messages

which indicate that the number of medical items stored in a storage location is below minimum

104

or out of stock. Generally such transaction messages will be generated by scanning a position bar code when the reading device is in the "default" mode due to no user being logged on. Alternatively, a prefix bar code indicia representative of a "below minimum" with location indicia, or an "out of stock" indicia at a location may be scanned at any time. This is represented

5   by logic process 406 which is indicated as the calling state in Figure 49. It should be understood that the calling state may be either process 394 or process 390 as indicated by process 406. As shown in Figure 49 from the calling state 406, provision is made when a restock order bar code is scanned from a report, to move to logic process 408 in which a user scans the bar code for the position being restocked. This enables a restocking user to indicate that the position is being

10   restocked. Also from the calling state, a user can scan a prefix bar code which may include quantity conditions such as below minimum, out of stock, or restocked, and then a bar code including a position or location. This causes the logic to move to process 410 which produces transaction records accordingly.

The logic flow process described in Figure 49 provides system flexibility. This logic

15   enables the user to scan sequentially a prefix label, and then a position label so as to selectively indicate a particular quantity condition for a storage location. This may be advantageous, such as for example, when a restocking user is scanning machine readable indicia from a report and from storage locations. Of course many arrangements of machine readable indicia both on reports and storage locations, as well as logic flow processes are possible depending on the needs of the

20   system operator.

The alternative system 322 shown in Figure 40 may be programmed to have the reading device 348 configured to operate in conjunction with the display terminal 338, rather than as a

105

completely separate user interface device. In some alternative embodiments it may be desirable for users to select patients using the screen 340 of the display terminal in the manner previously described when dispensing is conducted using the touch screen interface of the display terminal. Thereafter, the user may indicate taking of medical items from storage locations by scanning the machine readable indicia associated with those storage locations with the reading device. Likewise dispensers, electronic lock drawers, refrigerators or other storage locations, access to which is controlled by an access control device, may be operated so as to render medical items therein accessible in response to scanning of indicia associated therewith by the reading device. The taking of such items for the patient selected at the display terminal may be recorded in the data store upon such medical items being rendered accessible by the access control device, or may require further input to confirm the taking of the item either by scanning or by an input to the display terminal. The sequences and processes may be varied to suit the level of security desired for the particular medical items involved.

It should be understood that while the report generating means of the described alternative embodiment is a printer which enables the printing of bar codes, other embodiments may include other types of devices which may produce machine readable indicia. These may include devices which include hard copy or other types of displays or signals, which are capable of being read by a machine. Alternatively, in certain embodiments the reading device may be programmed to read human readable text provided on a report or other output device. In alternative embodiments audio, magnetic or other indicia may be substituted for the optical type machine readable indicia that have been previously described.

A further novel aspect of the alternative embodiment of the invention is associated with its capability of operating to perform dispensing and restocking activities despite other components of the system becoming inoperable. Specifically the reading device 348 may continue to operate to record dispense and restock transactions despite a malfunction of the display terminal 338, network 328 or any of the other connected computers or systems. As previously discussed, the reading device 348 generates transaction messages in response to the signals generated therein. The reading device is preferably configured so that if the batch transactions cannot be successfully transmitted to other parts of the system, such transactions will continue to be held in memory in the reading device. It may be desirable to continue to have the reading device hold a record of the transactions for a period of time, even though they have been successfully transmitted to other components of the system. This enables recovery of the data should it later be lost from the data store 326 or other connected system components.

The capability of the reading device 348 to store and later forward such transactions creates a possibility that quantity condition information may reach the data store 328 after later, more current information has been stored therein. It would be undesirable to modify more current information with previously generated data which may no longer be accurate.

To overcome this problem the transaction messages, as previously discussed, include a time of each transaction. The time preferably includes both time and date. The data store 326 likewise includes data representative of a time (and date) the data which is used to update the data store was generated. Upon receiving data from a reading device (or preferably any device such as a data terminal or other system component which has the capability of operating independently) the computer connected to the data store is operative to compare the time

107

information associated with the transaction data it is receiving with the transaction time of the

most recent data that it has already received. If the time associated with the transaction message

it is receiving is more recent than the update to the data it has most recently received, the data in

the data store is updated accordingly as is the transaction time information associated with the

5   update.

On the other hand, if the message being received by the data store is associated with a

transaction which occurred at a time which precedes a more recent update to the same data, the

computer 324 will not supersede the more recent data. Rather the computer is programmed to

store the transaction message data and use it for further processing. In certain cases the message

10   will be sent to the administrator's workstation so that a system operator may review whether the

data which the system has maintained needs to be modified.

An example of a situation where the computer 324 may have received more recent data

before older data is received is when persons restocking the system use other types of input

devices to indicate restocking data. The reading device 348 may generate a transaction message

15   which indicates that a particular storage location is out of stock. However, due to the periodic

transmission of the data from the reader, or other operational factors, the data store may not have

received the transaction data for a time after the user reads the indicia from the location. A

restocker using a separate message connection path into the network, such as a portable terminal,

may have restocked the position subsequent to the out of stock indication being read. The

20   restocker's data may have been received at the data store. Without the provision that is made in

this embodiment for checking the time information in the transaction messages, a subsequent

receipt by the data store of the message that has been in storage in the reading device would

108

wrongly cause the data store to indicate that the storage location was out of stock. Because the system includes the feature for selectively updating the data based on the time associated with the transaction message, the risk of such problems is minimized.

The ability of the system to selectively update the data store based on the time that message data originated enables the operation of alternative embodiments of the invention in which dispensers, lock drawers, refrigerator lock modules and other devices need not be in continuous communication with the other components of the systems.

In such an alternative embodiment electronic lock drawers, refrigerator lock modules, dispensers and other medical item storage devices which selectively control access to medical items, similar to those previously described, are used. However in this alternative embodiment such devices include or are in operative connection with a local processor and a memory. The local processor is connected to a local message input device and a local message output device of conventional types which enable the processor to send and receive messages. In one form of this embodiment the local input and output devices include IR receivers and emitters respectively, but other types of wireless or other connections may alternatively be used.

In this alternative embodiment the reading device used has operating characteristics similar to reading device 348 except that the reading device preferably includes a wireless interface that is capable of communicating with the display terminal or the network, as well as with the local message input device on the dispensing devices.

The local memory on the dispensing devices is preferably configured to hold data representative of authorized users, as well as medications stored in the various storage locations in the dispenser. The local memory is also configured to cause the processor to operate to make

medical items available in response to an appropriate message received at the local message input device. The local memory is further configured to generate transaction messages which include data similar to transaction messages generated by the reading device. The configuration of the local memory in the dispensing device is preferably established by downloading data into the local memory through the local message input device. This may be done using an IR communications interface in the network which communicates with the dispensers, or by using a portable terminal device to provide the configuration data.

In operation of this alternative embodiment, a user logs on the reading device in a manner similar to that described in the previous embodiment. The reading device operates in a stand alone manner based on its configuration data.

A user operates the reading device by scanning patient and medication data from reports or otherwise in the manner previously described. However, unlike the other embodiment where the reading device transmits its signal to the data terminal and the data terminal transmits a message on a data line to a dispenser, in this embodiment the reading device sends its output directly to the local message input device by IR coupling. The message from the reading device preferably includes data representative of the authorized user who is operating the reading device. The processor in the dispensing device preferably checks the user identity data against the configuration data related to authorized users in its memory. If the user is indicated as authorized, the dispenser makes the medical item indicated by the message available to the user. The reader also preferably provides as part of the message to the dispenser, data representative of the patient (if appropriate) and other data that is included in the transaction message eventually generated by the reading device. This information is also stored in the memory of the dispensing

device. Of course the processor in the dispenser may provide the time data and other data directly or from its local memory.

The dispenser through its local output device preferably provides data to the reading device representative of the storage location from which the medical item was provided. The reading device holds this data and incorporates it into its transaction message data.

The reading device is eventually again placed in communication with the network 328. This may be done by returning it to its cradle in which it is coupled by IR or in another manner to the network. The transaction messages produced by the reading device are used to update the stored data concerning the patients and the medical items in storage locations as in the previous embodiments.

Periodically data from the memory of the dispenser is delivered to the remainder of the system and used to verify the transaction messages from the reading device. This can be done through the local message output device being coupled to a receiving device connected directly to the network 328, or by use of a portable terminal which receives and stores the data. The portable terminal is eventually connected to the network. The computer comparable to computer 324 in this embodiment is programmed to compare transactions from the dispensers to those already received and to disregard duplicates of transaction already received. Any discrepancies may be directed to the appropriate function in the hospital or other facility in which the system is operated.

The reading device may also be used during restocking of storage locations in the dispensers in the manner previously described. The reading device provides messages which are

used to update the stored data. The data from the memory of the dispenser may be used to verify the reading device data and to identify discrepancies.

As will be appreciated, this alternative embodiment has the advantages that the dispensers and storage locations are totally "stand alone" units. This offers greater flexibility in their placement and reduces cost of installation of the system. The alternative form of the system further provides the advantage that if the reading device is lost or damaged, records of any activity conducted since the reading device last sent messages to the network can be recovered from the dispenser memories. The dispenser memories may be configured to hold data for such time after providing the data back to the network to assure data recovery.

It should further be understood that in this alternative embodiment more than one dispenser or similar device may share the same local processor, memory and input and output devices. Further, open storage locations may have a local processor, memory and connected input and output devices adjacent thereto to store a record of the transactions conducted with the reading device at the open storage location. Of course such processors and memories would not need to be configured to perform any dispensing control activities which would simplify installation and operation. Other arrangements and alternative systems will be apparent to those skilled in the art from the foregoing description.

The restocking of the various storage locations within the systems of the previously described embodiments may be facilitated using a method which includes the positioning of removable liners within the storage locations. In the execution of this method the liners are stocked with medical items at a remote stocking location such as in a pharmacy within a medical facility or at an offsite packing location. The liners are preferably secured and labeled with

112

indicia which indicate the locations where they are to be installed. This location identifying

indicia may in various embodiments of the invention include specific location data, indicia

representative of the particular type of medical items stored in the liner, or a combination of both.

The liners that have been loaded with the medical items are transported to the storage

5   locations. The storage locations are then accessed by a restocking user in the manner established

for the system. The previously installed liners are removed and the filled liners are then installed.

The devices securing the new liners in the closed positions are opened either before or after

installation of the new liners in the appropriate storage location. As later discussed, steps may be

taken to assure that the liners are properly installed. Medical items from a previously installed

10   liner may be transferred to the newly installed liner and a record thereof made. Alternatively the

previously installed liners may be secured with the remaining medical items stored therein.

The new liners are installed to replace the previously installed liners in a plurality of

different storage locations and dispenser devices, as well as in open or other types of storage

locations. The previously installed liners are returned to the stocking location for an accounting

15   of the medical items which may be still held therein, and for reuse.

A schematic view showing the steps of the restocking method is schematically

represented in 55. Figure 55 shows a system 530. System 530 may be similar to system 322 or

other systems previously described. It should be understood that additional hardware and

software features may be included in or connected to system 530, and that only certain features

20   and components are shown to facilitate understanding of the method.

System 530 includes one or more operatively connected processors and data stores. This

is schematically represented by computer 532, and data store 534 which is schematically shown.

113

The processors and data store are operatively connected and enabled to communicate through a network schematically indicated 536.

A plurality of display terminals of the types previously described are connected to the network 536. This is represented by a display terminal 538. It should be understood that in one preferred embodiment the display terminals 538 may also include a processor and data store therein. The display terminal 538 is shown schematically connected to a dispenser device 540. In the embodiment shown the dispenser device 540 is an electronic lock drawer of the type previously described. It should be understood that a plurality of dispenser devices of the various types described herein may be used in carrying out the restocking method. Such dispensing devices may include cabinets, refrigerators and dispensers for varied types of medical items.

While in the system 530 the dispenser devices are shown connected to the display terminal, in alternative embodiments of the invention the dispenser devices may operate as stand alone devices in the manner previously described. Such devices rather than being in operative connection with other devices in the system on a generally continuous basis, may have only periodic connection to other components of the system.

The embodiment shown in Figure 55 also includes a reading device 542. Reading device 542 has generally similar characteristics to the reading device 548 previously described. The reading device may be connected to the display terminal 538 by a line or through other communications methods. In one form of the invention the reading device 542 communicates through infrared signals. The display terminal 538 is in operative connection with an infrared transmitter and receiver schematically indicated 544. The reading device 542 may also be provided with a cradle 546 similar to cradle 354 previously described. It should be understood

114

that various approaches may be used in embodiments of the invention for communicating

between the reading device and the display terminal 538 and/or other components of the system.

The reading device 542 may remain at a position adjacent to an associated display terminal or

alternatively may to be carried by a restocking user to various locations throughout the system

5   where restocking activities are conducted. In this way the transportable reading device operates

in a manner similar to the reading device used in connection with stand alone dispenser units

previously described.

In one exemplary form of the invention a restocking terminal schematically indicated 548

is connected to the system through network 546. The restocking terminal 548 is preferably

10   located in a stocking location schematically indicated 550. The stocking location is preferably an

area where supplies of medical items are prepared. This may be a pharmacy within a medical

facility such as a hospital, clinic or treatment center. Alternatively the stocking location may be a

facility where inventories of medical items are available and may be packaged for transport.

Alternatively a stocking location may comprise a manufacturing facility where medical items are

15   manufactured.

The restocking terminal is preferably in operative connection with a report generating

device 552. The report generating device in the embodiment shown is a printer which is capable

of printing a restocking report schematically indicated 554. The restocking report 554 is

preferably similar to the type previously described which includes both human and machine

20   readable indicia concerning storage locations which require replenishment of the medical items

therein and the type of medical item which needs to be replenished. In alternative forms of the

invention the report generating device may be a device which provides such information either in

115

a visual or machine readable form which can be transported and/or transferred so as to facilitate the restocking of the locations.

In one embodiment of the invention the report generating device produces labels with machine readable indicia which can be applied in association with containers for medical items. The indicia is preferably a bar code representative of the storage location. The bar code representative of the storage location may be a location designator or indicia representative of the type of medical item stored in the container. Alternatively the indicia may be a combination of both the location designator and the medical item type.

Although the embodiment described produces transferable labels with the report generating device, in alternative embodiments other devices may be used to produce labels or alternative forms of indicia or information which can be transferred to a container. This may include for example optical indicia or electronic indicia including processor chips which may be programmed and attached to medical item containing devices.

In alternative embodiments the liners may be marked with a generally permanent identifying indicator, such as serialized machine readable indicia. In such a system data representative of the type of medical item placed in each container may be input and stored in the data store. Further in a concurrent or subsequent step data representative of the indicator for the container and a particular storage location may be stored in correlated relation in a data store. This would result in the container being assigned or addressed for subsequent placement in the storage location.

The type of report generating device used and the indicia which are associated with the containers for the various types of medical items will depend on the configuration and operation of the particular system.

An embodiment of a liner used in carrying out the method is shown in Figure 56. The liner generally indicated 554 is a portable container for housing medical items. The liner includes a front wall 556 and a back wall 558. The liner also has a pair of side walls 560. The side walls 560 include a plurality of spaced projections 562. Apertures 564 extend between adjacent projections on the exterior of the side walls.

The walls of the liner bound an interior area generally indicated 566. The interior area is bounded by a pair of opposed inside walls 568. The inside walls 568 include spaced slots 570 therein. The positions of the slots correspond to the projections 562 on the side walls 560.

At the top of each slot 570 are openings 572. Each of the side walls includes an outward extending flange portion 574. The openings 572 extend entirely through the side wall and a portion of the flanges 574. As shown in Figure 58, dividers 576 are enabled to be selectively installed in the interior area 566 of the liner. The dividers 576 are generally rectangular members with outward extending ears 578 adjacent the top thereof. The liner 554 and the dividers 576 are preferably comprised of relatively flexible plastic or other material that enables sufficient deformation so that the dividers may be manually installed in the slots 570. The installation of the dividers enables selectively dividing the interior area 566 of the liner into multiple compartments. The dividers 566 may have bar code or other indicia installed thereon for purposes that have been previously discussed. In addition the interior area 566 of the liner

117

includes a floor 580. Bar code or other indicia may alternatively be installed on the floor of the liner.

The interior area 566 of the liner 554 is bounded by a back wall 582. The back wall has a plurality of hinge access openings 584 extending therethrough. Supporting projections 586 extend between the hinge access openings and support a pivot portion 588 thereon. As best shown in Figure 59 pivot portion 588 is a generally round portion in cross section which serves as part of a hinge portion for holding a lid to the liner in a manner hereinafter discussed. The liner 554 further includes a front wall flange 590. Front wall flange 590 has an opening 592 therethrough the purpose of which is later explained.

Liner 554 is releasably engageable with a lid 594. Lid 594 has a generally planar top surface 596. The lid 594 is preferably comprised of transparent plastic material. A plurality of fingers 598 extend from a first end of the lid. As best shown in Figure 59, the fingers 598 are curved members which are sized to extend through hinge access openings 584. Fingers 598 are configured so they are movable in the hinge access openings and enable the lid 594 to be is pivotally movable thereon. The fingers 598 are part of a second hinge portion which works in cooperation with the first hinge portion on the liner to releasably engage the lid and liner together. It will be appreciated from the foregoing discussion that the lid 594 is engaged to the liner 554 by positioning the lid at an angle that is generally 90 degrees or greater relative to the floor 580 of the liner. In this position the fingers 598 may be extended through the cooperating hinge access openings 584. The liner 594 is then rotated to generally cover the interior area 566 of the liner, in which position the engagement of the fingers 598 and the pivot portion 588 hold the lid and liner in engaged relation at the first end of the liner.

The lid 594 further includes side wall flanges 600. Side wall flanges 600 extend

generally the full length of the liner along each side wall (see Figure 61). The side wall flanges

are configured so that they overlie the side wall flanges 574 of the liner when the lid is in the

closed position thereon. The lid 594 further includes a pair of spaced downward depending front

5   wall flanges 602. The front wall flanges generally extend downward and in overlying relation

relative to the front wall flange 590 on the liner. A front lid opening 604 extends through the

planar top portion 596 of the lid. The front lid opening is generally aligned with opening 592 in

the front flange of the liner. When the lid is positioned in covering relation to the liner the space

between the front wall flanges 602 on the lid generally corresponds to the position of the front lid

10   opening 604.

The aligned openings 604 and 692 in the lid and liner respectively, enable the end of the

liner and lid opposite fingers 598 to be held in engaged relation with a lock device. In one

embodiment of the invention the lock device comprises a tamper indicating seal generally

indicated 606 in Figure 60. The tamper indicating seal includes a strap portion 608. The strap

15   portion 608 is preferably flexible and can be extended through the aligned openings 592 and 604.

The strap portion preferably extends from a body portion 610 of the seal. The strap portion is

doubled back and accepted into an aperture in the body portion 610. The aperture preferably

includes one of a plurality of types of conventional one-way locks. Such one-way locks enable

the strap portion to be extended through the aperture in one direction but prevent movement of

20   the strap in an opposed direction. Once engaged the one-way lock cannot be opened without

breakage of the body portion or strap in a manner that would be readily apparent upon visual

119

observation. In this manner the tamper indicating seal 606 provides a visual indication if sealed liners are opened.

The tamper indicating seals are particularly valuable when the liners are transported by entities other than those who have the responsibility for loading them or unloading them into the storage locations. A restocking user who receives a liner with a damaged tamper indicating seal would likely be aware of the problem and can report a possible improper occurrence.

It should be understood that while one embodiment uses a strap type tamper indicating seal as a locking device, in other embodiments other types of locking devices may be used. Such locking devices may include key type or other types of locks that have components permanently associated with either the lids, the liners or both.

As shown in Figure 60 one exemplary form of the tamper indicating seal 606 has a label tag 612 connected thereto. Label tag 612 is preferably sized and configured for having machine readable indicia thereon. Such machine readable indicia includes in the described embodiment a bar code label which identifies the storage location and/or medical item in the liner. In alternative embodiments label tags may be placed on other areas of the lid or liner. Other forms of the invention may have generally permanent indicia on the lid or liner.

In alternative embodiments other types of indicia may be used. Such indicia may include for example other types of optical indicia like computer chips, programmable displays or other devices which can be used to identify the liner or the contents thereof. Other embodiments may use alternative forms of information recording devices including those which are permanently attached to the liners or lids or both.

120

As shown in Figure 56 lid 594 includes four projection segments 614 thereon. The segments each include two generally perpendicular wall portions 616 and 618. As shown in Figure 61 the wall portions are generally arranged at the corners of a rectangle. The rectangle which is bounded by the segments generally closely conforms to a lower portion of the liner. The profile of the lower portion of an adjacent liner generally indicated 620, is shown in phantom in Figure 61. The close conforming contour of the interior surfaces of the walls of the segment and the lower portion of the liner enable the liners to be readily stacked when the lids are installed thereon as shown in Figure 60. This feature restricts relative movement of the stacked liners during transport.

To further restrict relative movement of the liners, wall portions 616 which extend adjacent to the outer side walls 560 of the adjacent liner, include finger projections 622 thereon. As shown in Figure 61 the finger projections 622 extend inward relative to an adjacent liner. The finger projections 622 extend in an aperture 564 of an adjacent liner. At least one of the projections 562 of the side wall is adjacent to the finger projection when a liner is positioned in supported relation on the lid.

The exemplary configuration of the segments provides for a snug releasible engagement between a lid and an adjacent liner installed thereon. An adjacent liner is not only held in nested relation between the four segments 614, but is also held at each end by engagement of the finger projections 622 with an adjacent projection 562 on the outer walls of the liner. This configuration enables the liners with the lids installed thereon to be stacked in generally secure nested relation. It also prevents the liners from moving relative to one another while they are being transported. Liners with engaged lids may be stacked two, three and more high, depending

121

on the size of stack that can be easily handled. However when the liners reach an area adjacent to the storage locations the liners may be readily disengaged.

The configuration of the segments of the exemplary embodiment also enables the stacking of liners having different sizes. For example, a liner may be sized to include a bottom portion that has a profile that is similar in width but shorter in length than the liner just described. The exterior of such a liner includes apertures similar to the liners shown. This configuration enables holding the liner having the shorter bottom profile with the finger projections at only one longitudinal end of the liner. This limits shifting during transport of liners that have different sized lower portions. In addition, liners having a shorter lower portion profile may be selectively engaged in stacked relation with the finger projections on either longitudinal end of an adjacent lid.

In one form of the invention different sized liners are configured to be used with generally identical lids. For example, a deeper liner may be provided with a top opening that is configured to accept the lid used with a shallower liner. Other deeper liners may have an opening sized to accept identical lids, but may have a shorter lower profile so as to engage only finger projections on one longitudinal end of an adjacent lid when in stacked relation. Other configurations for liners may be made within the scope of the invention to suit the requirements of varied types of dispensers and storage locations.

As shown in Figure 57 the liners are configured to be accepted in the storage locations where medical items are held. In Figure 57 a drawer 624 of a dispenser device such as a lock drawer module is shown in the open and extended position. The drawer 624 has a storage location that is configured to accept the liner 554 therein. The storage location and the liner are

122

preferably configured so that the liner fits snugly in the storage location. The liner however is preferably readily removable from the storage location so that a substitute liner may be placed therein.

When the liner 554 is placed in the storage location and prior to the operation of the system, the lid 594 which covered the medical items in the liner during transport is preferably removed. The lid may be removed in some embodiments after the liner has been installed in the storage location. In other embodiments the lid may be removed prior to installation of the liner. The time when the lid is removed may depend on the particular type of storage location involved and the preferences of the restocking user. However as represented in Figure 57, before the system is operated the lid should be removed from the liner so that medical items such as item 626 in the liner may be accessed or otherwise appropriately dispensed from the dispensing device.

In an exemplary form of the invention the storage locations and liners are configured so that the liners can only be positioned in the storage locations in one orientation. This is useful for achieving a desired orientation for the medical items, as well as to achieve a standardized procedure for opening the liners and for orienting machine readable indicia that is positioned on the liners. Further in some circumstances different types of medical items may be positioned within a liner, for example in different compartments. The requirement that the liner may only be installed only one-way helps to assure that medical items are presented in a desired order.

It should be appreciated that while a liner suitable for use in connection with an electronic lock drawer type dispenser device is shown, in other embodiments other types of liners or transportable containers for holding medical items may be used. These may include liners

123

suitable for use in other types of dispensers as well as liners suitable for use in open type storage locations. The described approach of labeling the liners with indicia of the bar code type is exemplary, and other embodiments of the invention may employ other types of either permanent or temporary indicia for identifying the storage locations and/or the type of medical items held in

5   the liners.

The steps in the method executed using the liners is further explained with reference to Figure 55. In the stocking location 550 the liners are filled with the appropriate types of medical items and the lids are installed thereon. This step is schematically represented by a liner 628. At the stocking location the liners are preferably labeled with indicia which are indicative of the

10   storage locations in which the liners may be installed. As previously discussed this indicia may take the form of a bar code label which indicates the type of medical item placed in the liner. Alternatively the indicia may be indicative of a particular storage location or may be a combination of location and item information. The bar code indicia may be placed on the label tag of a tamper indicating seal or on the liner, the associated lid or both. Alternatively the liner

15   may have a generally permanent label and data correlating the type of medical item stored in the liner may be input through an input device and stored in a data store.

The filling of liners at the stocking location may be done in accordance with the restock reports 553. The restock reports are preferably produced by the report generating device based on information stored in the data store concerning which storage locations require replenishment.

20   The restocking report may include removable labels which are applied to the liners.

Because the restock report preferably includes both human readable as well as machine readable indicia, the removal of labels therefrom may still leave a useful report for use in

124

connection with transporting and installing the liners in the proper storage locations. Other embodiments of the invention may have machine readable indicia on the restock report in addition to the removable labels. As a result the restock report may be used in connection with machine reading devices even after the labels have been removed therefrom. Alternatively the

5   restock report and the labels may be generated separately. In embodiments where the liners have permanent indicia thereon the restock report may be generated by the computer based on the stored data indicating the medical items housed in particular liners. The computer may assign the liner to a storage location where medical items of the type held in the liner are required and indicate the locations in the report.

10   After the liners have been filled and preferably sealed with the lids at the stocking location, the liners are transported to the dispensing devices or other locations where they will be installed. This is graphically represented in Figure 55 by a stack 650 of such liners. The liners and lids are stacked in releasably engaged relation as many liners high as is convenient for handling. As previously indicated the liners may be transported to the storage locations along

15   with the restock report 553 which indicates where the liners are to be installed. Alternatively the restock report may be reproduced on a printer connected to the system at the hospital ward or other facility where the liners will be installed in the storage locations.

Once the liners are moved to the appropriate storage locations a user operates the appropriate display terminal 538, reading device 542 or other apparatus for accessing the storage

20   locations. This may be done in the case of the dispenser device 540 by opening the dispenser device so that an interior area thereof may be accessed. In one form of the invention this is done by the restocking user logging onto the display terminal 538 in the manner previously described,

and providing appropriate inputs to indicate that they are going to conduct a restock activity. The restocking user after appropriately logging into the reading device 542 may then read the indicia associated with the liner to be installed. This information is transmitted from the reading device to the display terminal which operates to determine from the nature of the indicia the location

5   where the liner should be installed. This is accomplished for example by comparing the type of medical item represented by the indicia on the liner to information stored in the data store. The processor connected to the data store determines where medical items of the particular type held in the liner are stored in the storage locations adjacent the display terminal. The processor then operates to open or otherwise make accessible the particular storage location where those

10   medical items are stored. In this example this is accomplished by opening the appropriate drawer in the electronic lock drawer module where the liner will be installed.

It should be understood that in alternative embodiments the indicia labeled on the liners may be directly representative of the storage location where the liner is to be installed. In other alternative forms of the invention or in circumstances where the particular medical item to be

15   restocked is not readily labeled with such indicia, a restocking user may read the indicia off the restock report 553. Reading the indicia off the restock report may also cause the appropriate storage location for the corresponding item to be made accessible to the restocking user.

After the storage locations for the medical items housed in the liner are made accessible, a previously installed liner is moved from the storage location and the new liner is installed.

20   Alternatively once a liner has been removed from a storage location the restocking user may scan the location indicia associated with the storage location with the reading device. This may involve for example scanning indicia in the storage location in the dispenser device where the

126

liner is to be installed. The indicia may be on a wall bounding the storage area which accepts

the liner therein or in another convenient location. Alternatively such indicia may be on the face

of a drawer in an electronic drawer module. Location indicia may be provided on a shelf such as

a shelf in a refrigerator or cabinet controlled by a lock or on an open shelf which supports the

5   liner in an open storage location.

When the indicia is read from the storage location with the reading device the information

read from the liner is compared to the information read from the storage location to determine if

the location is an appropriate location for that type of medical item. This may be done directly

by the processor within the reading device comparing the data read from the label tag associated

10   with the liner to the location indicia. Alternatively information from the reading device may be

transmitted to the display terminal which then operates to determine if the location where the

liner is to be installed is appropriate. If it is determined that the restocking user may be installing

the liner in an improper location, a signal is given to the restocking user. This helps minimize

the risk that restocker will place the medical items in improper storage locations.

15   The process of scanning the indicia associated with the liner, scanning the indicia

associated with the storage location and replacing the previously installed liner with the new liner

is repeated for each storage location where replenishment is required. It should be understood

that in embodiments of the invention the scanning of the indicia associated with the new liner

and the storage location may be done either before or after the existing liner is removed and the

20   new liner is installed therein. The order of the steps may vary based on the nature of indicia and

the personal preferences of the restocking user.

127

The transparent lids enable machine readable indicia applied inside the liner to be read with the lid installed. The transparent lids also enables visual observation of the contents of the liner which saves time and reduces the risk of error.

Either before or after installing a new liner in a storage location, the tamper indicating seal is broken and the lid is removed so that the medical items in the liner become accessible. This step is represented schematically in Figure 55 by liner 632. After the interior area of the newly installed liner is made accessible, medical items from the previously installed liner may be counted by the restocking user and transferred to the newly installed liner. The number of items transferred is preferably input to the system by the restocking user using the reading device 542 in the manner similar to that previously described. This transfer of medical items from the previously installed liner to the newly installed liner is represented by liner 634 in Figure 65.

In alternative embodiments of the invention the previously installed liner including the medical items which remain therein may be returned to the stocking location for audit. Such medical items may also be reviewed to determine if their expiration date has passed or if for some other reason they should not be reused. In these circumstances the lid removed from the newly installed liner may be installed on a previously installed liner and engaged thereto with a tamper indicting seal. This is represented in Figure 65 schematically by a liner 636.

When the previously installed liners are to be returned to the stocking location with the lids installed thereon they may be stacked in nested relation in the manner previously described. This is schematically represented in Figure 55 by a stack 638 of such liners. Alternative forms of the liners and lids may be configured to stack in nested relation when empty. When the medical items have been removed from such alternative liners, the liners and lids may be segregated or

128

stacked randomly in the manner represented by stack 640. It should be understood that in situations where the liners are returned with medical items therein the tamper indicating seals which hold the lids in engagement with the liner may include numbers representative of the restocking user who sealed them in the storage location or other information that enables tracking of where they originated. Alternatively in situations where indicia was printed on the lid of the new liner that was installed in the storage location this indicia may now become associated with the previously installed liner at that location and an indication thereof stored in the data store based on inputs from the restocking user.

When previously installed liners are returned with medical items therein an audit is conducted at the stocking location of the medical items. To do this the returned liners are opened as indicated schematically by a liner 642. The medical items are counted and the number compared to the information input by the restocking user. Of course if there is a discrepancy or a liner is returned with the return tamper indicating seal broken the possible problem may be promptly investigated.

Medical items removed from a returned liner may be inspected for their suitability for further use. If the items are not suitable for reuse they may be discarded. If the items are suitable for reuse they may be returned to inventory or immediately placed into another liner.

At the restocking location tags which are indicative of storage locations for particular medical items held in liners may be removed. Alternatively, other devices for storing information, such as memory chips on the liners, may be cleared. This enables the liners and lids to be used to hold other types of medical items which are destined for storage in storage locations other than the one from which the liner was removed.

The medication dispensing system of the present invention may be used in connection with a plurality of different types of devices which store and dispense medical items. For purposes of narcotics, which are tightly controlled, a medicine dispenser which holds the medical items in a secure enclosure prior to dispense and which dispenses such items in a manner that can

5 be controlled and confirmed is preferred. Medicine dispenser 100 is such a dispenser that is used in connection with dispensing medications. A further example of a suitable dispenser is shown in U.S. Patent No. 6,019,249, the disclosure of which is incorporated herein by reference.

The interior of medicine dispenser 100 is shown schematically in Figure 27. Dispenser 100 encloses a plurality of dispenser magazines 168 only one of which is shown. Each magazine

10 holds a plurality of ampules, vials or other medication holding containers 170 which are held in inclined relation in the magazine. Each of the containers in a particular magazine contains a predetermined dose of a substance such as a narcotic material that may be prescribed to a patient. Many forms of cylindrically packaged medications or medical items may be held in the magazines. Medicine dispenser 100 optimally houses a large number of magazines, each one

15 holding vials with a particular type of medicine. Each magazine 168 includes a dispensing mechanism later described in detail that releases containers in response to electrical signals one at a time from the lower end of the magazine. Released vials are guided on a chute 172 into a pocket 174 in a drawer 176. Drawer 176 may be a simple drawer or in alternative embodiments may be controllably locked and unlocked by an electronic lock 178 shown schematically inside

20 the medicine dispenser. Each magazine has a dispense verification sensor 179 associated therewith. Sensor 179 is operable to detect the actual dispense of a container from a magazine. Sensor 179 may be an optical, mechanical or other suitable sensor type.

130

When medicines are requested at the display terminal 102, the appropriate containers from the magazines 168 are released and fall down the chute into the pocket 174. After the vials have been released and are in position in the pocket, they may be taken. In alternative embodiments in which the drawer is controlled, the data terminal 102, in response to signals from the computer 84 unlocks the electronic lock 178 and enables the drawer 176 to be pulled outwardly so that the containers in the pocket may be taken.

Replenishment of the medicine dispenser 100 is accomplished by manually replenishing the magazines and indicating that fact through the data terminal in the manner previously described. To accomplish this the medicine dispenser has to be opened. This is possible only under the most secure of circumstances and through the use of a mechanical locking system comparable to that which is conventionally used to secure narcotics. Normally, two keys are required to open the unit and each key is in the possession of a different person.

The operation of the dispensing mechanism is shown in greater detail in Figures 14 through 26. Figure 14 shows the vials or other containers 170 in the magazine 168. As shown in Figures 15 through 17 because the magazine is tilted downward the containers tend to roll towards the front of the magazine toward an opening 180. The container adjacent the opening 180 contacts a guide 182 which is dog-legged in cross section. Guide 182 includes a tapered face 184 which is engaged by the first container 202 in the magazine. Guide 182 further includes an arm portion 186 that extends longitudinally adjacent the vials. Arm portion 186 has attached adjusting pins 188 which extend through the side walls 190 of the magazine. Adjusting pins 188 extend in angled slots 192 and may be fixed at selected positions therein using nuts mounted on the pins or other suitable locking fasteners.

131

The movable mounting of the guide 182 enables the magazine to accommodate different diameter containers by moving the guide in the slots 192 to provide sufficient clearance for a container to pass onto the guide adjacent opening 180 but not so much clearance so that the vial can fall out the opening without the actuation of the gate members as later explained.

As best shown in Figures 18 through 20, a front gate 194 and a back gate 196 are mounted adjacent to opening 180. The front gate and back gate are mounted on a front gate shaft and a back gate shaft 198 and 200 respectively.

As shown in Figure 18 in the inoperative position of the gate members front gate 194 engages the underside of first vial 202 adjacent opening 180. The end of front gate 94 engages container 202 at a position outward towards opening 180 from a location on the surface of the container diametrically opposite where container 202 engages tapered face 184 of guide 182. As a result, the container 202 is prevented from passing out through opening 180. In this position any force applied to container 202 (if it could be accessed) would tend to be resisted by compressive forces making it very difficult for the container to be manually removed. In the inoperative position of the magazine shown in Figure 18 the back gate 196 has its upper end extending parallel to a bottom wall 204 of the magazine. As a result, in this position the back gate does not interfere with movement of the containers.

In the actuation sequence for dispensing a container, the back gate rotates in a clockwise direction to the position shown in Figure 19 As it does this the back gate begins to move to a position blocking the container immediately behind container 202 in the magazine from moving toward the opening 180. In the position shown in Figure 19 the front gate 194 remains in its original blocking position holding container 202 in the magazine.

132

After the back gate has begun to rise as shown in Figure 19, the front gate begins to rotate in a clockwise direction toward the position shown in Figure 20 As the front gate 194 rotates container 202 is no longer held in the magazine and passes out the opening 180. The back gate having fully rotated as shown in Figure 20, holds the next container in the magazine from moving until the front gate returns to its original position shown in Figure 18 When this occurs the back gate returns to its original position allowing the containers to roll forward and the next container is now in the position of container 202.

In an exemplary embodiment of the invention, the slots 192 are oriented such that for any size container reasonably accommodated in the magazine, the front and back gates are positioned so that the front gate 194 may assume an over-center blocking position in the closed position and the back gate can move to prevent the dispense of more than one container at a time. This ensures that with each cycle of the front and back gates only one container is dispensed.

The actuating mechanism for the front and back gates is shown in Figures 21 through 26 As shown in Figure 21 the actuating mechanism for the gates includes an electrical solenoid 206. Solenoid 206 has an actuating plunger member with a pin 208 extending traversely therefrom. Pin 208 extends traversely in a first slot 210 in a first actuator plate 212 which is attached to the front gate 194. Pin 208 also extends through an opening 214 in a second actuator plate 216 which is attached to back gate 196. As best shown in Figure 22 first actuator plate 212 has a traversely extending finger 218. In the position of the front gate shown in Figures 21 and 22, finger 218 engages a detent 220 in the second actuator plate 216. The purpose of detent 220 is to prevent finger 218 and front gate 212 from moving in a clockwise direction whenever the second actuator plate 216 is in its inoperative position as shown in Figures 21 and 22 This prevents a

133

person who may gain access to the front of the magazine from being able to deflect the front gate so as to cause the containers to be removed from the magazine.

As shown in Figures 23 and 24 the actuation of solenoid 206 by an electrical signal from the data terminal causes pin 208 to move second actuator plate 216 in a clockwise direction. This causes back gate 196 to move upward and detent 220 to disengage from finger 218. As a result, front gate 194 may move only after back gate 196 has risen so as to block the dispense of further containers. Upon further movement of pin 208 by solenoid 206 the front and back gate move to the positions shown in Figures 25 and 26. In these positions the front gate is rotated so as to release container 202 while the back gate is extended fully upward so as to prevent the discharge of the next container in the magazine. Thereafter, discontinuance of the electrical signal to solenoid 206 returns the gate members to their original positions and allows the next container to assume the position adjacent to the opening from the magazine.

The dispensing mechanism of the present invention enables the controlled dispense of one container at a time from the magazine in response to an electrical signal. This assures that only the requested medication is dispensed. The same magazine may be readily adapted to containers or items of varying diameter by adjusting the position of guide 182. The magazine also accommodates containers of different lengths. In addition, the gate members are suitably secure so as to avoid tampering by persons who might attempt to gain access to the interior of the medicine dispenser 100 through the dispenser drawer 176.

The dispensing mechanism also assures that the requested medical item has been dispensed. This is assured by using signals generated by sensor 179 to minimize the risk that a dispense will be recorded which has not actually occurred due to a malfunction. Circuitry in the

134

dispenser is connected to the sensor 179 and transmits signals when a container passes out of a magazine. These signals are checked to see if they are generated when a signal to dispense to the corresponding magazine is given. The dispense of any item from a location and the provision of such item to a patient is only recorded in the computer data store when the dispense is verified by

5   the sensor associated with the magazine. Alternatively, in other embodiments a bar code reader may be installed in the dispenser and bar code applied to the containers to verify not only the dispense but the type of item dispensed.

Although in the above described embodiment of the medicine dispenser the gate members are shown as extending the entire width of the magazine, in other embodiments the gate members

10   may have other configurations and may be of different designs so as to extend only a portion of the width. Although in the preferred form of the invention the magazines extend in downward tilted relation in other embodiments they may be arranged to extend vertically. In such alternative embodiments guides may be provided to hold the containers adjacent to plate 204. Further, the containers may be dispensed in a vertically upward direction through incorporation

15   of spring loading to bias the containers upward in the magazine. A useful aspect of the invention is that the gate member which corresponds to the front gate member engages the container in an over-center position with regard to where the container contacts the tapered face, and the back gate member moves in synchronized relation with the front gate member to prevent the dispense of more than one container at a time.

20   The system for monitoring and dispensing medical items which includes the hook registers, box registers, electronic lock drawer, refrigerator lock modules and medicine dispenser previously described may also include or be used with other types of devices. These may include

135

automatic dispensing devices as well as manual devices for which the inventory and use

information can be input as a matter of practice at a conveniently located data terminal. The

system of the present invention is highly adaptable to accommodate medical facilities of varying

size. As the system of the present invention is also connected to a variety of computers which

5   include data stores, a wide variety of parameters may be monitored and evaluated so as to avoid

conditions of waste, fraud and abuse.

A further alternative embodiment of a system is shown in Figure 62 and is generally

indicated 650. System 650 is generally similar to system 322 shown in Figure 40. Certain of the

components discussed in connection with the system shown in Figure 40 are also shown in

10   connection with system 650. It should be understood that these components operate in a manner

similar to that previously described and that other components described in connection with

system 322 of Figure 40 may also be present in system 650.

System 650 is an exemplary embodiment of a system where medical items which have

been tracked to the point of being taken by a user for use by a patient are further tracked to the

15   point of giving the particular medical items to the patient. As previously discussed as described

in this description the act of "giving" a medical item to a patient includes any use of the medical

item in connection with treatment of patient. In system 650 report generating devices are used

for generating reports. These include for example report generating device 384 which generates

a report 388. In system 650 a report generating device 652 such as a printer is used to generate a

20   hard copy report 654. A report generating device 656 which includes an output screen produces

a display 658 which is an electronic report. In each of these embodiments reports are generated

responsive to data stored in the data store 326 in response to operation of computer 324. Of

136

course as previously described this computer and data store are exemplary and embodiments of the invention. The computer and data store may actually comprise a plurality of operatively connected computers and data stores.

The reports generated by the report generating devices preferably include information concerning patients and medical items that have been prescribed for the patients. The reports generated may also include other information such as the location of the patients and the time or frequency that particular medical items have been prescribed for use in the treatment of the patients. In addition like the reports previously discussed the reports generated by the report generating devices may include machine readable indicia which may be read by a reading device for purposes of carrying out functions related to the system such as dispensing and tracking activities. While in the described embodiment the use of bar code is discussed as the machine readable indicia, it should be understood that in other embodiments of the invention other forms of machine readable indicia may be used.

In the embodiment shown reading devices are used to read the machine readable indicia on the reports that are generated for purposes of dispensing and tracking the medical items. A reading device 60 operates in a manner similar to reading device 348 previously described. Reading device 660 like reading device 348 may be used to scan indicia representative of a patient and/or a medical item prescribed for the patient as presented on a report generated by one of the report generating devices. In response to scanning the patient indicia, the medical item indicia, or both, a user operating readers 60 may cause medical items to be dispensed or otherwise made accessible, such as from medical item holding devices 344, 346 or 527 previously discussed. By reading such indicia the reading device also causes data to be stored in

137

the data store representative that a particular medical item has been taken for use by a patient. Of course as previously discussed the operation of dispensing a medical item or inputting the information to indicate that the medical item has been taken for use by a patient may be done through a combination of inputs to a reading device and a display terminal such as display

5   terminal 338 shown.

In the embodiment schematically represented in Figure 62 the report generating devices may generate a report that indicates medical items which the system indicates to have been prescribed for particular patients. These prescribed item reports also preferably include machine readable indicia corresponding to the prescribed medical items. These prescribed item reports

10   may be identical or the same reports that are used to dispense medications. Alternatively the prescribed item reports may be generated specifically for use in connection with giving medical items to patients. The prescribed item reports may be hard copy reports which may be taken to a bedside of a patient by a person administering medication. Alternatively in the case of electronically generated reports such as those generated by display 658 the reports may be

15   generated on screens or other output devices adjacent to the bedside of a patient.

In the exemplary system of Figure 62 portable terminals such as terminal 652 are used for recording the giving of medical items to patients at a patient's bedside. The portable terminals 652 include a way of communicating with the network 328. These may include wireless connection methods of the type previously discussed or alternatively may include physical

20   connections such as electrical contacts. In the embodiment shown a docking port 654 is shown for accepting the portable terminal 652. The docking port 654 may operate in a manner similar to the cradle used in connection with reading device 348 and may operate to download data from

138

the portable terminal 652 as well as to upload into the terminal configuration and other data. As schematically represented in Figure 62 the portable terminal 652 includes a data store schematically represented 666 therein. It should be understood that in embodiments of the invention the prescribed item report data may be loaded from the system into the data store 666

5   of the portable terminal 652. This may enable a user to execute the functions of the portable terminal described hereafter without the need of utilizing a separate prescribed item report external of the terminal.

In the exemplary form of the portable terminal the terminal includes at least one input device 668 and at least one output device 670. In the exemplary embodiment shown the input

10   device includes keys and the output device includes a screen. However it should be understood that in other embodiments other types of input and output devices may be used. It should further be understood that portable terminal 652 may in embodiments of the invention operate in a manner similar to a personal digital assistant which may receive inputs and instructions by way of a stylus or similar device brought adjacent to a screen or other output device thereon. It

15   should be understood that various types of portable terminals may be used in embodiments of the invention.

Portable terminal 652 of the described embodiment further includes thereon a communications device 672. Communications device 672 is suitable for use in communicating messages between the portable terminal and other devices. For example in exemplary

20   embodiments of the invention the communications device may include an infrared transceiver or other wireless type communication device. The communication device 672 may also be used for

communicating with the remainder of the system through the docking port 654 or through other

communication devices that are connected to the network 328.

Exemplary portable terminal 662 further includes therewith a terminal reading device

674. In the exemplary embodiment the terminal reading device 674 includes a stylus for reading

5   machine readable indicia such as bar code. The terminal reading device 674 serves as a further

input device for the terminal 662 and in alternative embodiments the reading device may be

incorporated into the housing of the terminal or into other connected devices. Further the

terminal reading device 674 may in embodiments of the invention include other functions such as

a stylus for inputting data into an input device of the terminal. The terminal reading device 674

10   may also in other embodiments provide an input device for reading information provided by

other instruments such as instruments used for monitoring bodily functions and vital signs of a

particular patient. Of course this may also be done in alternative embodiments through the

communications device 672 or other receiving devices associated with the portable terminal.

In the embodiment shown patients are generally associated with beds schematically

15   indicated 676, 678 and 680. In the use of the portable terminal 662 medical items are tracked to

the point of giving the medical items to the patients in the beds or adjacent the bedside. Of

course it should be understood that in other systems patients may not necessarily be associated

with beds but rather with wheelchairs, rooms or the like. The exemplary embodiment of the

present invention is equally applicable to and may be used in connection with such systems.

20   In the described embodiment each individual patient is associated with at least one patient

associated item. The patient associated item preferably includes an item including machine

readable indicia that is in proximity to the patient. For example a patient of associated item may

140

include a band 682. Band 682 may be applied around an arm or leg of a patient. The band may include machine readable indicia that corresponds to the patient and/or other information. Alternatively the machine readable indicia may include a bed label such as label 684 applied in connection with bed 676. Alternatively the patient associated item may include machine

5   readable indicia on a bedside chart such as chart 686 shown in connection with bed 678. Further alternative embodiments of the invention may have the patient associated item include a bedside terminal such as terminal 688 shown in connection with bed 680. Bedside terminal 688 may include a screen similar to screen 658 which produces machine readable indicia thereon. Bedside terminal 688 may also be in connection with network 328 through various types of

10   communication devices. For example in Figure 62 bedside terminal 688 is shown in communication with a wireless transceiver 690. Of course various types of contact or contactless communications may be used for communicating between the network 328 and the bedside terminal 688. Also in exemplary embodiments of the invention the bedside terminal 688 may communicate with the portable terminal 662 through the communications device 672 and a

15   compatible communications device operatively connected to the bedside terminal.

In operation of the system 650 represented in Figure 62 a record is made using the portable terminal 662 that a medical item has been given to the patient. The information concerning the giving of the medical item is stored in the data store 666 of the portable terminal and is transferred through the network 328 so that data representative of the fact that the medical

20   item has been given to the patient is stored in the data store 326. The procedure used for accomplishing this may vary depending on the configuration of the portable terminal 662 as well as the preferences of the institution operating the system and the user giving the medical items to

141

the patient. In one exemplary embodiment a user signs on the portable terminal 662 in a manner similar to signing on to a reading device such a s reading device 348. The user may scan machine readable indicia on their badge or other identification article with the terminal reading device 674. The user in addition or in the alternative may be required to insert a personal

5   identification number through the input device 668 of the portable terminal. Alternatively the portable terminal may include a fingerprint reader or other input device for receiving identifying information which confirms that a user is authorized to operate the portable terminal. Once the user has signed on to the portable terminal, the user may use the terminal reading device 674 to scan machine readable indicia indicative of a medical item being given to the patient proximate

10   to the time it is given to the patient at the patient's bedside. The user may also scan the patient associated item to confirm and cause to be stored in the data store 666 of the portable terminal that the medical item corresponding to the read indicia was given to the patient. In embodiments of the invention the configuration stored in the portable terminal 662 may cause such information to be stored in response to the scanning of indicia representative of a medical item and a patient

15   associated item within a particular time period. Alternatively or in addition the user may provide additional inputs through one or more input devices on the portable terminal so as to indicate the giving of particular medical items to the patient.

The portable terminal 662 in the described embodiment is carried to the bedside of a plurality of patients and the process repeated for each medical item given to each respective

20   patient. This causes a record to be stored in the data store 666 of the portable terminal of the patients the medical items have been given thereto as well as other information such as the time of giving the medication, the condition of the patient at the time the medical item was given as

142

well as other information. The variety of information that may be recorded depends on the capabilities of the input devices, the terminal reading device and the configuration of the system. After the information concerning the giving of medical items to the patients is captured in the portable terminal 662, the portable terminal of the exemplary embodiment is returned to the docking port 654. The information concerning the giving of medical items to the patients is then transferred from the memory in the portable terminal through the network 328 and data representative of such information is stored in the data store 326.

In embodiments which employ bedside terminal 688 the bedside terminal may operate to receive messages from the portable terminal 662. These messages may include information representative of the medical items being given to the patient as well as other information. This information may be recorded in the bedside terminal for purposes of charting the progress of treatment of the patient. This information may be transmitted from the bedside terminal 688 through the wireless transceiver 690 to the remainder of the system. In such embodiments this may avoid the need for the transmission of such information from the portable terminal through the docking port. In alternative embodiments the information transmitted from the terminal and the bedside terminal may be compared to insure accuracy. Of course it should be understood that in embodiment of the invention, the portable terminal 662 may communicate through the network 328 without the use of a docking port and that information stored in the portable terminal may be communicated on a read time basis or periodically in a batch mode.

In alternative embodiments where the prescribed item report is stored in the memory of the portable terminal 662 the user may review the indicia presented through the output device 650 and may input the inputs indicative of the medical items and/or the giving of items to

143

patients through the input devices on the portable terminal. In such embodiments the reading of the patient associated items may not be necessary to record the giving of medical items to the patient. However even in such embodiments the reading of the patient associated items may be preferred as a verification to assure that medical items are given to the proper patients as

5   indicated in the prescribed item report. Of course various combinations for reading indicia representative of the prescribed medical items for patients and patient associated items may be used to indicate and/or confirm the giving of medical items to patients.

In the exemplary system 650 an administrator terminal 692 is shown in connection with the network 328. The administrator terminal 692 may in embodiments of the invention be an

10   administrator work station (AWS) of the type previously described or other type terminal. The administrator terminal 692 is in operative connection with a report generating device 694 which generates reports schematically indicated 696. In embodiments of the invention the administrator terminal 692 is used to determine instances where medical items which have been taken for use by patients have not been administered to the patients. This is accomplished through operation

15   of the computer 324 from the information stored in the data store 326. It will be recalled that the taking of the medical items for the particular patients is represented by data stored in the data store. Likewise in embodiments of the invention the particular user who has taken such medical items by causing them to be dispensed or otherwise is also represented by data that is stored in the data store. After the medical items have been given to the patient the data representative

20   thereof as well as other information such as the time of giving the medical item is also represented by data that is stored in the data store. Through operation of the administrator terminal 692 and the report generating device 694 instances where medical items that have been

144

taken but which have not yet been recorded as given tho the patients may be identified. Such

information may be useful in tracking errors or irregularities in the giving of medical items. In

addition devices in connection with the system for returning or wasting of medications in the

manner of the allowed patent applications which have been incorporated herein by reference may

5   provide data to the system which may be analyzed and reported through the report generating

device 694 to identify instances where medical items were returned to the system rather than

being given to patients. The administrator terminal 692 may also operate to include in the reports

696 the reasons why such items were not given to patients. Such information may be particularly

useful in situations where the medical items involved were narcotic items which require close

10   tracking.

The exemplary embodiment of the system 650 is useful because it provides for storing

data in the data store of the distribution cycle of medical items. This includes tracking medical

items from the source such as a pharmacy or other supply to the storage locations or dispensing

devices which is accomplished through the tracking during the restocking function. In addition

15   medical items are tracked from the dispensing or taking of the medical items for use by the

patient. The medical items are further tracked to the giving of the medical items to the patients

or alternatively the return of medical items that are not given. The system thus enables more

accurate tracking and minimizes the risk of losses or abuse.

A further alternative embodiment of a system of the present invention is indicated 700

20   and is schematically shown in Figure 63. System 700 is generally similar to system 322 shown

in Figure 40. System 700 however has the additional capability of enabling patients to dispense

medications themselves through a self service dispenser. System 700 also enables patients to

145

obtain their medications on an outpatient basis as well as to make payment for medications using a credit or debit card account. The exemplary embodiment of the System 700 also enables charging a benefits provider such as the patient's health insurance company for the amount that they owe for the medical item given to the patient. This assures that the patient's personal

5   account is only charged the appropriate co-pay amount.

In the operation of system 700 data concerning medications that are prescribed for patients are input through a physician terminal 702. Physician terminal 702 may be located in a physician's office. This may be a physician's office associated with a medical practice located in proximity to a hospital clinic or similar inpatient care facility. Alternatively the physician

10   terminal may be located remotely from the computer 324 and may connect to the network 328 via a remote communications method such as via modem or by a public or private network. Alternatively the physician terminal 702 may be one of the terminals that is used for entering prescription data for patients that are being treated on an inpatient basis within a hospital or other resident care facility in which the System 700 is used.

15   In the system 700 the physician terminal is used to input prescription data for a patient. The prescription data preferably includes information such as the patient name, the medical item prescribed and the physician's name. In addition the physical data may include the condition for which the medication has been prescribed and an instruction for its use. Such instructions may include for example the number of tablets or capsules that the patient is to take within a given

20   time period. Alternatively for other types of medical items the prescription data may include instructions for application of the medical item. In addition the prescription data may also include instructions or warnings concerning the medication and possible side effects and any

146

information that the physician may find appropriate to include in the prescription data. The prescription data input through the physician terminal 702 is transmitted through the network 328 to the computer 324. The computer 324 causes data representative of the prescription data to be stored in the data store 326. As can be appreciate the prescription data input through the

5   physician terminal 702 may be similar to the prescription data previously described that is stored in the data store 326 for patients who are treated as inpatients in the facility that utilizes the system of the invention.

System 700 further includes a database 704 in operative connection with a computer 706. Data store 704 includes data representative of payment rules which are used for determining

10   benefit amounts that patients are entitled to receive as benefits from a benefits provider. These payment rules include information necessary for calculating the benefit amount that the benefit provider is required to pay when a patient receives medical items in the course of medical treatment. Data store 704 in addition to including payment rules for one or more benefit plans also includes data representative of benefits providers for other entities required to make

15   payments that are associated with each particular benefit plan. In the exemplary embodiment the benefit provider is the payor entity who is generally required to make at least a partial payment of a benefit amount for medical items used to treat patients. Data store 704 further includes data representative of patients and the benefit plans or benefit providers with which particular patients are associated. Computer 706 operates responsive to the data stored in the data store 704 and

20   information regarding a patient and a medical item prescribed for the patient to determine the benefit plan and the respective rules for receiving benefits by the patient. Computer 706 is also preferably operative in response to the stored data and other information to determine the benefit

amount that is required to be paid by the benefits provider on behalf of the patient as well as any co-pay amount that a patient receiving a medical item is required to pay personally for medical items.

It should be understood that while in the exemplary embodiment the data store holding the benefit plan rules is shown as a separate data store in connection with a separate computer, in embodiments of the invention the benefit plan information may be stored in database 326 and processed by computer 324. Alternatively in other embodiments the payment rules and benefits plan information may be divided between a plurality of computers and associated data stores.

In the exemplary system 700 network 328 is in operative connection with a communications processor 708. In the exemplary embodiment communications processor 708 is a firewall or similar communications device that operates to enable network 328 to communicate with other networks while preventing unauthorized access from outside the network 328. It should be understood that following the exemplary embodiment a server type firewall is used. In other embodiments other types of communications devices and approaches may be used.

In system 700 shown communications processor 708 is connected through a network 710 to a computer operated by at least one benefits provider schematically indicated 712. In an exemplary embodiment network 710 is a public network that is capable of communicating with a plurality of computers including a plurality of computers operated by different benefit providers. Each computer operated by a benefits provider is preferably operative to receive information representative of benefit amounts that each respective benefits provider is obligated to pay on behalf of patients who are enrolled in the their respective benefits program. The computers operated by the benefits providers are preferably operative in response to receiving information

148

concerning benefit amounts due to issue the appropriate payments to the institution providing

medical items to patients including medical items provided by self service dispensers in a manner

hereinafter discussed.

Communications processor 708 is also preferably operative to connect network 328 to

5   other remote computers such as remote computer 714. Computer 714 preferably has in

connection therewith a data store schematically indicated 716 which holds a registry of medical

history information concerning patients who may receive medical items from the system. Data

store 716 may include a national or regional repository of medical history information and may

be operated by public or private authority. Alternatively computer 714 and the information in

10   data store 716 may be provided by benefits providers for a consortium thereof. Alternatively the

medical history information accessible through computer 714 may be medical history

information available in a computer at another medical care facility where a particular patient has

previously received medical treatment. As later explained the medical history information

accessible through computer 714 may be operated to supplement history information that is

15   available in the HIS System 332 operated by the particular care facility in which the system of the

invention is operating. In the exemplary system 700 network 328 is also in operative connection

with a plurality of self service dispensers one of which is schematically indicated 718. Dispenser

718 is in connection with the network 328 through the communications processor 708 and

through a network 720. Network 720 may include a public or private network of any type

20   suitable for communicating with the dispenser 718. Network 720 may include a telephone or

data network which is connected to the dispenser either on a permanent or a periodic dial up

basis.

In the exemplary embodiment self service dispenser 718 is generally similar in its operation to dispenser 100 previously described. Dispenser 718 is selectively operative in response to messages from computer 324 to selectively dispense medical items. Self service dispenser 718 also includes a user interface 722 generally similar to the interface used in connection with the display terminal previously discussed. Interface 722 includes input devices such as a keypad 724, card reader 726 and touch screen 728. User interface 722 also includes an output device which in the exemplary embodiment is the touch screen. It should be understood that while in the exemplary embodiment certain input and output devices are shown, in other embodiments other types of input and output devices may be used. In addition while in dispenser 718 the input and output devices are shown integrated with the housing of the dispenser, in other embodiments of the invention the input and output devices may be mounted on other structures generally adjacent thereto.

In the exemplary embodiment of the self service dispenser 718 the dispenser housing includes a receipt printer schematically indicated 730. Receipt printer 730 which is schematically represented by a receipt outlet in the dispenser is operative to provide patients using the self service dispenser with written receipts for medications dispensed and/or transactions conducted at the dispenser. Exemplary dispenser 718 further includes a label printer schematically indicated 732. Label printer 732 operates in a manner later discussed to print and provide labels to a patient using the self service dispenser.

Network 328 is also in operative connection through the communications processor 708 in the exemplary embodiment with financial transaction processing systems. In the exemplary embodiment schematically represented network 328 is in operative connection with a credit card

150

processing system schematically indicated 734 and a debit card processing system schematically indicated 736. The network 328 operatively connects to processing systems 734 and 736 through a network 738 which in the exemplary embodiment is one or more private transaction processing networks. Of course this configuration is exemplary and in other embodiments financial transactions may be processed through other systems and networks including public networks such as the Internet.

The operation of the system 700 is represented in the logic flow shown in Figures 64-67. To enable operation of the system information concerning benefit plans and the rules for providing benefits associated with those benefit plans is first stored in the data store 704. This is done in a step 740. Patient identification information which indicates the identities of the patient and the particular benefits plan and/or benefits provider with which they are associated is also stored in this step. Such information may be input to the system through the physician terminal 702 at administrator work station, admitting work station or other computer connected to the network 328. The information concerning benefit plans and plan rules may also be imported from another system into the database 704.

When a physician prescribes a medication for a patient who will receive it through the self service dispensing terminal, the prescription data is entered through the physician terminal 702. The data entered through the physician terminal generally includes prescription data including data typically entered in connection with medications which have been prescribed for patients on an inpatient basis as previously discussed. The prescription data may include for example the patient name, physician name, medical item, condition treated and one or more instructions for taking or using the medication. This prescription data may also include other

data related to the patient for a medication such as potential side effects or the term during which medication is to be taken. In addition the prescription data may also include other identifying indicia such as the patient's member number associated with their respective benefit plan as well as benefit plan information and other data. The prescription data is entered into the system in a step schematically indicated 742. The prescription data is transferred through the network 328 to computer 324 and data representative of the prescription data is stored in the data store 326.

In the exemplary embodiment a check is made concerning the prescription data prior to giving the prescribed items to the patients for possible conflicts. This process is indicated in Figure 64 in a step 744. In an exemplary embodiment the checking step 744 includes checking the medical history information related to the patient. This may include for example checking whether the patient may be allergic to particular medications prescribed and whether the medication which has been prescribed for the patient may have an interaction with other medications that the patient is currently taking. The checking step 744 in the exemplary embodiment is preferably done through the pharmacy system 334 which checks local history data that is available in connection with the system or facility where the medication has been described which is generally the HIS system 332. Alternatively or in addition a check may be made of the remote repository of medical information. This may be done by exchanging messages with computer 714 through the network 710. The remote history information which is schematically indicated as stored in data store 716 and which is accessed through computer 714, any medical history data stored in a large public or private repository. This may include for example information stored in other hospitals or treatment care facilities where the patient has been treated in a repository maintained by the patient's benefit plan provider or HMO or in the

152

offices of the patient's other treating physicians. In embodiments of the invention several remote

repositories of medical history data may be checked for information concerning the patient.

Using this information the pharmacy system 334 makes a determination whether it is acceptable

based on the patient's medical history and other information to dispense the medication to the

5   patient. This determination step is represented by step 746..

If in the step 746 it is determined that there is some reason why it may not be appropriate

to give the prescribed medication to the patient the system operates to send a message back to the

physician advising the physician of this. This is preferably done through an electronic message

to the physician terminal 702. Alternatively the message may be provided through a phone call

10   to the pharmacy operation or through other appropriate means. The step of notifying the

physician is represented in Figure 64 by a step 748. In response to being notified in step 748 the

physician prescribing the medication may take appropriate action such as contacting the patient

and/or providing for a different course of treatment with a different prescribed medical item.

Assuming that it is acceptable to provide the prescribed medical item to the patient

15   information concerning the patient and the prescription data is stored in the database 326 in a

manner which indicates that the prescribed medical item is to be given to the patient. This is

represented by a step 750.

In operation of the exemplary system shown in Figure 700 once the patient and

corresponding prescription data has been stored in the system the information remains waiting

20   for the patient or other person acting on their behalf to access the information through the system.

This is represented in a step 752. In some circumstances such data may reside in the system for

an extensive time without the medical items that were prescribed for the patient having been

taken. The computer 324 in the exemplary embodiment is operative to monitor the situations where a prescribed item has not been taken by the patient and if a set period elapses a notification is given to the physician prescribing the medical item for the patient that the patient has not taken the medication. The process executed by the computer 324 in determining if a prescription has existed for too long without being taken by the patient is represented by a step 754. This step of notifying the physician that the patient has not taken their prescribed medication form the system is represented by a step 756. Of course upon being notified that the patient has not received their medication the physician may take appropriate action to follow up with the patient to determine if there is a problem and/or why they have not taken their medication.

In the usual operation of the exemplary system a patient eventually approaches a self service dispenser such as dispenser 718 to receive their prescribed medication. This process generally begins by the patient entering identification data at the self service dispenser. This is represented in Figure 65 by a step 758. The process of the patient identifying themself depends on the particular embodiment of the system. For example the patients identify themselves by entering a unique identifying number such as a patient number or their member number associated with their particular benefit plan and/or provider. Alternatively the patient may identify themselves by entering a social security number or similar identifying data. In other embodiments a patient may simply input their name to the system through the keypad 724 or other input device. Also as represented in a step 760 in exemplary embodiments a patient inputs a credit or debit card into the card reader 726 of the self service dispensing terminal. It should be understood that data encoded on such a card such as the patient's name may also be used to identify the particular patient.

154

In response to receiving the patient identifying information and/or credit or debit card data at the self service dispensing terminal the information is communicated through the network 720 into the network 328. One or more computers such as computer 324 operates to determine if there is data in the data store 326 corresponding to pending prescriptions for the identified

5   patients. This is represented in a step 762. A determination is made in a step 764 by the computer whether there are prescriptions pending for the particular patient. If no prescriptions are found the terminal 718 displays this to the patient through the output device 728. This is represented by a step 766. If prescriptions are found in the data store messages corresponding to the prescriptions are sent by the computer 324 through the network 328 and to the self service

10   dispenser 718. The prescription data for these portions thereof are displayed to the customer through the output device 728. This is represented by a step 768. In this exemplary embodiment of the invention at least a portion of the prescription data is displayed to the patient so that the patient may make a determination that the prescription information stored in the data store is consistent with their understanding of the medications that have been prescribed for them. A

15   prescription data will generally include items such as the name of the doctor and the condition for which the medical item has been prescribed, the customer will be able to compare this information to their understanding of their condition and course of medical treatment. If by some chance an error has been made this will likely be apparent to the patient from the prescription data which is being displayed to them.

20   In response to the prescription data being displayed to the patient through the dispenser terminal 718 messages from the computer 324 or alternatively the computer operating in the dispenser 718 operates to prompt a user through the output device on the dispenser to provide an

155

input to indicate whether or not the prescription data that is being displayed is correct to their understanding. This is schematically represented in a step 770. The patient then responds at a step 772 to indicate whether they believe that the displayed prescription data is correct. If the patient indicates that the data is not correct a message including the input is transmitted back through the system to the computer 324 which notes the discrepancy in the data store. This is represented by a step 774. The computer 324 in the exemplary embodiment also operates to notify the physician with a message that the patient indicated a discrepancy and that the prescription data was incorrect. This was indicated at the step 776. In response to receiving such a message the physician may contact the patient or take other steps to determine the nature of the problem. The self service dispensing terminal in response to having the patient indicate that they do not believe that the prescription data is correct operates as indicated in a step 778 to display an appropriate screen through the output device 728 apologizing to the patient for the inconvenience. The terminal then proceeds in response to computer 324 or a computer operating in the dispenser terminal to execute the sequence to close the transaction which is later discussed.

If in the step 772 the patient indicates that they believe that the prescription data is correct a message indicative thereof is transmitted back through the network to the computer 324. The computer 324 then operates to calculate a cost associated with the medical item that is to be dispensed to the patient. This is represented in a step 780. In response to the cost of the medical item to be provided being calculated, the computer 706 or other computer in the system operates in response to the benefit plan information and rules to calculate the benefit plan information which applies to the patient, the particular medical item that has been prescribed and the cost. This includes in the exemplary embodiment determining the benefit provider associated with the

156

patient. It also includes calculating the benefit amount that the benefit provider is required to

contribute towards payment for the medical item as well as the amount of any co-payment that

the patient is required to make. This is represented by a step 782.

In response to determining the amount of the benefit and co-payment an electronic

5   message is sent to the dispenser 718 concerning the amount of the cost for the medical item and

particularly the amount of the patient's co-payment. This information is displayed to the patient

through the output device 728 of the terminal in a step 784 shown in Figure 66. At a step 786 the

output device of the dispenser terminal is operated to display a prompt requesting the patient to

indicate if they accept the charge for the amount of the co-payment.

10   In response to the prompt given to the patient, patient at a step 788 either indicates that

they do not accept the charge or that the charge will be accepted. In situations where the patient

does not accept the charge messages are transmitted to the computer 324 or other connected

computer which generates a message back to the dispensing terminal 718. In response to the

message received by the dispensing terminal the terminal operates to provide the patient with

15   contact information for purposes of resolving the apparent disagreement concerning the amount

that the patient is going to be required to pay. This is indicated by a step 790. Providing the

patient with such contact information may include displaying information to the patient through

the output device 728 and/or providing the information to the patient in hard copy with the

printer 730. In addition to providing the patient with information concerning who to contact to

20   correct the apparent problem the computer 324 also operates as represented in a step 792 to

notify the physician of the apparent problem. This enables the physician to follow up with the

patient to be sure that there medication is promptly received. The terminal 718 then operates to execute a sequence later described to close the transaction.

If in the step 788 the patient indicates that they accept the charges then the computer 324 operates in a manner previously described to determine the storage location in the dispenser 718 that has been prescribed for the patient. This is indicated in a step 794. If the computer determines that the particular medical item for some reason is not present in the dispenser the mediation cannot be provided. If such a determination is made as represented by a step 796 then the patient is notified through the output device on the dispenser at a step 798 that the medication is not available. Thereafter the computer 324 operates to execute the steps of providing the patient with contact information and notifying the patient's physician as previously discussed before closing the transaction. Of course as previously discussed the computer 324 may also operate to generate restocking messages so that if the medication is not present due to being out of stock then appropriate action may be taken to reload the particular medical item in the dispenser.

If the medical item that has been prescribed for the patient at the self service dispenser is present in the dispenser, the computer is then operative to recover from the database the prescription data which is to be printed by the system on a prescription label which is provided with the medical item. In addition or in the alternative the computer 324 may also operate to look up certain instructions or information concerning the prescribed medical item so that it may be provided to the patient. This may include for example instructions on how to take or use the medical item. It may also include for example food or other situations to be avoided when taking the medical item. Such information may be stored in one of the datastores in the system such as

158

in connection with the pharmacy system 334. The lookup of this information is represented by a step 800 in Figure 66.

In response to determining the label information and/or particular instructions that are to be provided to the patient with the medical item the computer 324 is operative to send messages to the self service dispenser 718. In response to the messages sent the printer 730 is operative to print the instructions on paper or other appropriate device for the patient. In addition the label printer 732 is operative to print a medication label such as a self adhesive label that may be applied to the container which holds the pills or other medical item which is being dispensed for the patient. These printing activities are represented by a step 802.

In this exemplary embodiment the dispenser dispenses cylindrical containers in which are the medical items dispensed to the patients. These containers may hold a variety of pills, capsules or other types of medical items. In the exemplary embodiment the label printer 732 provides a label to the patient operating the terminal which the patient may apply to the medical item immediately after it is dispensed. Of course in other embodiments the self service dispenser terminal may include mechanisms therein for applying the prescription data to the medical item. This may include for example printing a label within the dispenser and then applying the label to the medical items using the mechanism within the dispenser prior to the medical items being provided to the patient. Alternatively medical items may include a label thereon when loaded in the dispenser. In the process of dispensing the medical item indicia corresponding to the prescription data may be printed on the label such as through applying printing with an inkjet printer as the medical item is passed adjacent to the printing device. Various alternatives for applying labels or printing to the medical item may be used in embodiments of the invention.

159

These various alternatives may include applying the prescription indicia either before or after the dispensing of the medical item.

Returning to the logic flow discussed in connection with this exemplary embodiment, the computer 324 or other connected computer utilizes the account information read from the

5   patient's credit or debit card or other information which may be contained in memory to generate a financial transaction message. This financial transaction message comprises one or more messages which are sent electronically through the network 738 to the appropriate credit card or debit card processing system. These messages are operative to charge the account associated with the card presented at the self service dispenser for the amount of the co-payment that is due

10   from the patient. The generation of these one or more financial transaction messages are represented by a step 804. The charging of the account associated with the card is operative to provide the entity which operates the self service dispenser with the patient's share of the payment that is due on account of the dispensing of the medical item.

As represented in Figure 57 the computer 324 or other computer operated in connection

15   with the system is also operative to generate messages to the benefits provider associated with the patient. These messages are operative to charge the benefit provider with the benefit amount which the benefit provider is obligated to pay under the patient's benefit plan. This is represented by step 806 in Figure 67. In response to receiving the message requesting the co-payment the computer such as computer 712 operated by the benefit provider associated with the

20   patient is operative as indicated in step 808 to indicate through a return message to the computer 324 whether the benefit provider accepts the obligation to pay the benefit on behalf of the patient.

In the exemplary embodiment if the benefit provider refuses to accept a transaction the computer 324 is operative to note the discrepancy in a step 810. The computer also sends messages to the terminal 718 which outputs information through the output device 728 and/or the printer 730 of the contact information for the patient to resolve the discrepancy. This is represented by a step 812. In addition the exemplary embodiment causes the computer 324 to operate to send a message to the physician through the physician terminal 702 or otherwise to notify the physician that the patient did not receive their medication. This is represented by a step 814. The output device on the dispenser 718 is also operated to display the apology screen to the patient at a step 816 before closing the transaction. In addition in embodiments of the invention where the patient's account has already been charged for the co-payment amount, the refusal of the payment of the benefit by the benefit provider may cause the computer 324 to operate in accordance with its programming to reverse the charge for the co-payment to the patient's account. This is done through the exchange of electronic messages with the debit or credit card processing system. Alternatively the transaction messages exchanged with both the benefit provider and the credit and debit card processor may require an initial commitment that the funds will be made available prior to sending a subsequent message which is operative to transfer the funds. It should be understood that various approaches to the plural transaction messages are within the scope of the invention depending on the capabilities of the systems operated by the benefit provider and the credit and debit card processing system from which the patient pays the co-payment amount.

If in a step 808 the benefit provider accepts responsibility for payment of the calculated benefit amount computer 324 is operative to cause the self service dispenser to deliver the self

adhesive label that has been printed by label printer 732 to the patient. Likewise if the label is applied through a mechanism within the dispenser, the mechanism which applies the label operates to attach it to the medical item to be dispensed. Likewise instructions that are to be provided to the patient with the dispensed of the medication are delivered to the patient from the printer 730. This is represented schematically in a step 818.

In response to the dispense being authorized the self service dispenser terminal then operates in a step 820 to dispense the medication to the patient. In response to dispensing the medication such as in response to sensors within the dispenser of the type previously discussed sensing that the medical item has been dispensed messages are sent to the computer 324. The computer operates to include data in the datastore 326 representative of the fact that a medical item has been dispensed for this patient. This may include information concerning the dispense including the time and location thereof or other information that is considered to be pertinent such as the account of the patient used to make the co-payment and the benefit provider and benefit amounts. The computer 324 also operates to indicate that the prescription for the patient is no longer open and waiting to be filled. This is represented by a step 822.

The printer 730 is also operative to print a receipt for the patient concerning the transaction. This may be in the nature of a transaction receipt for the debit or credit card payment that the patient has made for the co-payment amount. Alternatively the print receipt data which is provided to the patient may be integrated onto the same form with instruction information that is printed concerning the dispensed medical item. This is represented by a step 824.

In the exemplary embodiment described in connection with Figure 63 the patient is required to apply the prescription label to the medication after the medical item has been

162

dispensed. In this exemplary embodiment a sensor is provided for sensing the presentation of the label to the patient. The sensor is in connection with a computer in the self service dispenser or elsewhere in the system and in the exemplary embodiment prevents further operation of the transaction until the patient takes the self service label for purposes of applying it to the

5   dispensed medical item. Such a feature may be particularly valuable in systems where the dispenser is configured to dispense a series of prescribed medical items for the patient. For example in such alternative embodiments the customer may be prompted after a first item has been dispensed to indicate that they are ready to accept the dispense of another medical item which may have been prescribed for the patient. Appropriate outputs to the output device of the

10   terminal may be provided for this purpose. If the customer provides appropriate inputs to indicate that they wish to have the additional medical item dispensed such further activity is prevented until after the label has been taken from the presentation physician and the physician has applied that label to the dispensed medical item. Appropriate prompts may be provided through the output device of the self service dispenser to assure and remind patients to take this

15   step and in this way the risk of patient confusing multiple medical s items or installing labels correctly is reduced. Of course in alternative embodiments where labels are applied automatically within the dispensing unit. Such features may not be required.

If after step 824 no further medical items have been prescribed for the patient for the patient or if the system is programmed to end the transaction after the dispense of a single

20   medical item the computer operates to control the self service dispenser 718 to return the customer's card at a step 826. After returning the card the dispenser operates to display through its output device a courtesy screen such a screen thanking a customer for conducting the

163

transaction or reminding them to contact their physician if they have any questions or concerns about their prescription. This is represented by a step 827. Thereafter the computer may operate the self service dispenser to return to a wait state waiting for the same or another patient to operate the terminal.

5   It should be understood that the logic flow shown herein is exemplary and in other embodiments of the invention other logic flows, self service dispensing devices and system configurations may be used.

An advantage of systems of the type which are used to track and dispense medications to patients on an in-patient basis may be extended to patients who are receiving treatment on an outpatient basis. This may be particularly valuable in situations where a medical care facility has many physicians therein who appreciate the convenience of being able to see patient on both an inpatient and an outpatient basis. The present invention enables such physicians to provide prescription information for patients in both categories through their offices. In addition patients which are seen on an outpatient basis may receive their medications quickly and very close in time to their visit with the physician. As patients requiring medications are not often feeling well the inconvenience and ordeal of traveling to a drugstore or other remote location to obtain their medications may be avoided. In addition exemplary embodiments of the system provide the advantages associated with tracking the dispense of medical items previously discussed in connection with other embodiments of the invention.

20   A further alternative embodiment of a system is shown in Figure 68 and is generally indicated 830. System 830 is generally similar to system 700 shown in Figure 63, system 650 shown in Figure 62, and system 322 shown in Figure 40. Components and features discussed in

164

each of these previously described systems may be used in connection with system 830. It should be understood that these components may operate in system 830 in a manner similar to that previously described. Various combinations of components and features previously described may be combined in connection with system 830 even though not schematically shown in Figure 68.

System 830 includes a local area network 832 which provides for electronic communication between components of the system. It should be understood that local area network 832 may be one (1) or more interconnected systems which enable devices to communicate. Local area network 832 may extend within a single facility such as a single hospital or a clinic. Alternatively, local area network 832 may be a private network that extends between a group of facilities in which various components of the system are positioned.

In connection with local area network 832 are a plurality of display terminals schematically represented by a display terminal 834. Display terminal 834 may be similar to other display terminals 76, 98, 102, 338 previously described. Display terminal 834 has in connection therewith one (1) or more computer memories schematically shown, which hold information and programs. Display terminal 834 is operatively connected to devices for controlling access to medical items. These items are schematically represented by a medication dispenser 836, an electronic lock drawer 838, an electronic lock cabinet 840 and hook registers 842. Of course, various types of other devices which include storage locations for medical items may be in connection with display terminals in embodiments of the system. Reading devices such as reading device 844 which may be similar to reading device 348 and/or other reading devices previously discussed may also be used in connection with the system.

165

Local area network 832 is also in connection with other computers such as nursing station computer 846. Nursing station computer 846 is representative of the computers that may be placed at nursing stations in a hospital or similar facility. Such computers may be used to provide inputs to the system concerning activities involving the treatment of patients. Nursing computer 846 may be used to also receive information such as information relating to medications and treatments which have been prescribed for various patients within the institution. Nursing station computer 846 may also be used as an alternative to a display terminal 834, and may also be used in situations where automated types of dispensing devices are not available. Nursing station computer 846 may be used to provide information concerning items taken or replaced in storage areas adjacent to the nursing station. The system may record the status of storage locations which users can access adjacent to the nursing station computer. The system may keep track of medical items stored in such storage locations in a similar manner as the system uses to track medical items which are removed from or added to other locations in the system. The tracking of medical items in such storage locations are represented in Figure 68 as virtual storage 848. Nursing station computer 846 may also have in connection therewith an output device such as a printer 850 for purposes of printing reports related to activities occurring or scheduled to occur.

Local area network 832 in the exemplary embodiment is also in connection with one (1) or more additional computers. Such computers may include, for example, computer 852. Computer 852 in the exemplary embodiment is operative to store and process information concerning medical items in storage locations, patients and medications prescribed for such patients, authorized users of the system, the taking and giving of medications for patients, as well

166

as other information of the type previously discussed. In addition in the exemplary embodiment computer 852 is operative to store information concerning activities in the pharmacy. Such activities as later discussed may include the receipt and disposition of medical items as well as the storage and disposal of items. One (1) or more pharmacy terminals 854 is in connection with the local area network 832 for purposes of communicating information with appropriately connected computers. Pharmacy terminal 854 includes output devices such as a printer 856. Printer 856 may be used in a manner such as that previously discussed for printing reports which include information or indicia which correspond to items which need to be restocked in various storage locations, the status of various storage locations and/or the need to order supplies or other information. Storage enclosures or facilities such as vaults 858 are also schematically indicated in the pharmacy. The storage vaults may include access controlled storage areas such as cabinets, compartments, drawers, or rooms. Such storage vaults may be manually controlled or electronically controlled to limit access to authorized persons in a manner similar to electronic lock drawers or other controlled storage devices as previously described.

Exemplary system 830 further includes administrative terminals schematically represented by administrative terminal 860. Administrative terminal 860 may be used for programming the system, setting up storage locations, enabling users to selectively operate aspects of the system, monitoring activities and for engaging in other types of activities such as those previously discussed.

Network 832 is also in operative connection with one (1) or more other computers schematically represented 862. Computer 862 may be used to process other information such as information in the facility's hospital information system (HIS) or in a facility's admission

167

discharge and transfer (ADT) system. Of course many other types of systems may be in connection with network 832.

System 830 further includes one (1) or more computers including one or more processors, which computers are schematically indicated 864 which serve as a gateway to other systems. In the exemplary embodiment, computer 864 serves as a firewall for limiting access to and from network 832. As schematically indicated in Figure 68, computer 864 enables access to a wide area network 866 such as the Internet.

Wide are network 866 is schematically shown connected to a variety of other types of exemplary computers and systems. For example, network 866 may be operatively connected to self service medication dispensers 868, 870 of the types previously discussed. Wide are a network 866 may also be in connection with other computers such as a financial transaction processing computer 872. Financial transaction computer 872 is indicative of one (1) or more computers which can process transactions such as debit or credit card transactions related to persons who receive medical items in the course of operation of the system. Alternatively or in addition, one (1) or more financial transaction computers may be operative to settle accounts between various entities connected to the system such as a hospital and its employees and/or suppliers. Alternatively, financial transaction computers may be used for the hospital to receive or make payments from third parties such as insurers or other hospitals such as hospital 874 schematically indicated in Figure 68. Suppliers who are in communication with network 866 are schematically represented 874 and 876. It should be understood that many additional types of providers of goods or services may be connected through one (1) or more networks to the system 832.

168

In exemplary system 830 shown in Figure 68, medical items may be obtained from a supply cabinet schematically indicated 878. Cabinet 878 is in operative connection with a display terminal 880. Cabinet 878 is used to control access to items held therein. Items stored in the cabinet are enabled to be accessed in response to inputs to the system and/or the display

5   terminal in a manner similar to that previously discussed. It should be understood that a plurality of cabinets 878 may be in connection with a single display terminal or other adjacent computer. Alternatively cabinets such as cabinet 878 (as well as other devices for holding medical items) may be directly connected to the system or operated off line with periodic connection to other system components in the manner previously discussed.

10   In some embodiments of the invention devices which control access to medical items may be operative in response to a voice activated user interface schematically represented 877. For example, speech recognition software operating in one or more computers of the system may be operative to recognize verbal information and instructions from authorized users. The system may then operate to make selected medical or other items available and/or receive information

15   about items being taken (or restocked) through the voice activated user interface.

In an exemplary embodiment, a voice activated user interface may be associated with one or more display terminals or dispensing devices and may be used for inputting instructions and/or information. This may be all or a portion of the instructions or information previously described as input through display terminals, reading devices or portable terminals. For example, an

20   authorized user may be able to select a patient name by stating the patient's name instead of providing manual or other inputs to a display terminal or other device to identify the particular patient for whom items are being taken or returned. In an exemplary embodiment the system

169

may indicate that the system has recognized the input through the voice activated user interface by providing a visual output, such as screens or visual outputs through the display terminal of the types previously described.

Verbal inputs from the user through the voice activated user interface may be used to obtain information about selected patients. This may be the types of information previously described that are output through the display terminal such as the items prescribed for the selected patients or other data. This may be output on the screen of the display terminal or in another manner. Such outputs may include synthesized speech outputs provided to the user through the voice activated user interface.

In exemplary embodiments a user may dispense medical items from dispensers by providing verbal inputs. For example, the user may state a command like "dispense (item name)", "deliver (item name)" or "take (item name)." In response to receipt of such an input a dispenser may dispense the requested medication type. Alternatively, if the medication type requested is in a drawer or cabinet, the appropriate door or compartment would unlock to provide a user with access. In exemplary embodiments, the voice activated user interface may also advise a user where the particular type of medical item may be found such as the particular drawer, cabinet or dispenser location, and/or the particular area or position within the drawer or cabinet where the item is located. For example, storage locations may be labeled with indicia such as numbers, letters, colors, characters or combinations thereof.

The system may have stored in one or more data stores information on medical items stored in particular storage locations, as well as data which correlates the storage location data to the identifying indicia and/or a synthesized voice sound (or sounds) file(s) which produces the

170

output(s) to indicate to the user where the requested item is found. For example in response to the user's verbal input discussed above, the voice activated user interface might output "(item name) is in cabinet number 1, compartment 3, position 7"). This would then guide the user to the location where the item is found.

5   In addition or in the alternative, in some embodiments the user may provide verbal inputs to indicate what they are taking from the system. This may be done in cases where the user accesses cabinets or drawers that hold multiple items. For example the user may provide a verbal input such as "taking two (item name)", "removing two (item name)" or "dispensing two (item name)." Such an input would be recognized through operation of one or more computers to

10   cause the data corresponding to what is taken from the system to be stored in one or more data stores. In some embodiments a user may indicate the storage location data from which an item is being taken. This may be in addition to or as an alternative to stating the item name. It should be understood that some embodiments may be programmed to recognize the storage location name, the item name, or both. Of course other approaches may be used.

15   In some embodiments an authorized user may be allowed to access items in many locations in response to a master command. For example a user may provide a master command such as "browse everything", "open everything" or "access all" which will then open all the locked storage locations to which the user has access. Alternatively a master command may apply to only a particular storage device or group of storage locations, such as "open cabinet 1."

20   The user can then take items from the plurality of storage areas and provide verbal inputs as to what the user is taking. In some embodiments the opening and/or closing of drawers and other compartments may be sensed and used as a basis for inquiring of a user as to what was taken.

171

For example, upon sensing the opening of a particular drawer the user may be asked "what are you taking from drawer (number)." The user may then provide a verbal response such as the name of the particular type of medical item and quantity , or if the user did not take anything the user may state "nothing." The connected computers may then operate to verify that the items

5   indicated as taken are appropriate for the inputs provided. The computers then operate to update the stored data related to the appropriate patient, user, storage location, medical item, quantity on had or other category or type of data in a manner similar to that previously described.

In an exemplary embodiment the voice activated user interface causes one or more computers to operate so that the associated display terminal produces corresponding screens like

10   those previously described. In this way the user may verify that their verbal inputs are understood by viewing the screen of the display terminal. The user is also enabled to switch to carrying out of the transaction via manual inputs if that is desired. This may be desirable in situations where the user does not wish to or cannot speak the commands, or in cases where the system is not understanding the verbal inputs of the user. Of course in other embodiments other

15   approaches may be used. These may include for example, having one or more computers programmed to understand and interpret human language words and syntax. This may enable authorized users to verbally state what they want to do, or are doing, in any of a variety of ways (including different languages or names of items, such as brand or generic name) and have the system understand. It should also be understood that embodiments of the invention using speech

20   recognition features may advantageously identify authorized users by vocal and/or other biometric features. This may facilitate the speed at which authorized users are identified and may provide enhanced security.

<center>172</center>

Embodiments of the invention may also receive inputs or provide outputs through the

voice activated user interface for purposes of returning items previously taken, as well as for

restocking of item storage locations. This may be accomplished to carry out these types of

activities as previously discussed by providing data of the types described as input or output

5   through the display terminal, reader or portable terminal, through the voice activated user

interface. In embodiments of the invention the voice activated user interface may be used in

connection with controlling access to medical items, including medications, devices, supplies,

instruments, materials and other items.

It should be understood that the transactions mentioned in connection with the voice

10   activated user interface are exemplary. Of course additional options for dispensing, taking,

returning and/or restocking items may be used including those previously discussed herein. For

example, in embodiments of the invention, reading devices may be used either in a line

connected or wireless environment for capturing information from reports and storage locations

for activities related to either dispensing from or restocking particular storage locations. This

15   information may be supplemented with data or instruction provided through the voice activated

user interface. It should also be understood that while the cabinets and the display terminal are

operated in this exemplary embodiment in an "online" mode, other embodiments of the invention

may operate as an offline device in the manner previously discussed. The voice activated user

interface may also operate as an offline device. Such devices may record instructions or

20   information and thereafter periodically report such information to the system through an

intermittent connection or through an intermediate terminal or other device. Numerous

173

alternative embodiments of the invention will be apparent from the discussion herein to those having skill in the art.

Another aspect of the described system 830 is the functionality of the software which operates in one (1) or more computers of the system to track activity from the pharmacy. Such activity in the described embodiment enables the tracking of medications into storage in the pharmacy either from inside or outside of a particular facility. The system further enables tracking the removal of medical items from the pharmacy. This may include, for example, withdrawing medications to place in storage and later providing such medications to patients. Such removals may also include taking medications for compounding. Such removals may also include situations where medications have passed their expiration date, have been recalled or are wasted for other reasons.

The exemplary form of the system also enables tracking medications which are quarantined in storage in the pharmacy. This may include outdated or recalled medications which must be disposed of in accordance with particular specified procedures to comply with legal requirements or good practice. Further aspects of the described form of the invention tracks external activities such as medications that are loaned, sold or borrowed. Further aspects of the exemplary system enable medications to be bought and sold electronically in the manner previously discussed from suppliers or other users. The exemplary system also includes audit capability which enables inventory verification and reconciliation to effectively track medications that are stored in the pharmacy. The exemplary system further includes additional functions which are later described.

The pharmacy control functions in the described embodiment of the system are carried out by users operating computer terminals or other terminals located in connection with the pharmacy such as pharmacy terminal 854 schematically represented in Figure 68. The pharmacy terminals provide an interface for receiving inputs and for providing outputs that enable tracking of the medical items in the pharmacy. It should be understood that the software which executes the instructions to carry out the activities related to tracking activities in the pharmacy may operate on one (1) or more computers connected to the system. In the exemplary system 830, shown in Figure 68, the pharmacy information is accessible through a local area network 832 from computer 852. Of course it should be understood that various arrangements of computers and data stores may be operated in connection with embodiments of the invention.

Authorized users of the pharmacy software are initially required to identify themself as an authorized user of the pharmacy terminal or software. This may be done in one or more of the ways previously discussed for identifying authorized system users. Of course user may have different levels of authority in the system and only users authorized to conduct activities in the pharmacy may conduct transactions (or a portion of available transactions) at terminals located therein.

The pharmacy tracking functions that are carried out in one described embodiment are now explained with reference to the screen outputs shown and described in connection with Figures 69-96. These screen outputs are exemplary and in other embodiments other screens may be used. Figure 69 shows a main menu screen 1210. Screen 1210 shows the various transactions that are tracked through operation of the described embodiment. The transactions include three (3) selections which relate to placing a medication in secured storage. These are a deposit

175

transaction, a return to a pharmacy vault and a return compound. Other exemplary transactions that are tracked involve removal of medications from secure storage. These transactions are withdrawal, compound, expiration, recall and waste.

Other transactions that are tracked in this described embodiment are storage within a quarantine vault. A quarantine vault provides interim storage in the pharmacy for outdated or recalled medications, or other items that are held pending transfer or disposal. Further activities which are tracked in this exemplary embodiment are referred to as external. External activities include the tracking of medications that are loaned, sold or borrowed by the pharmacy and which involve an external transaction with another related or unrelated entity. The final option shown in screen 1210 is the audit function. The audit function is used in connection with inventory verification and reconciliation.

Figure 70 shows menu screen 1210 in which a deposit transaction has been selected. Such a selection is made by providing an input. This may be done through an input device in operative connection with a computer such as a mouse or a touch screen. In a deposit transaction, medications are deposited into storage in the pharmacy, usually by a pharmacist or pharmacy technician. The system operates to create a "deposit events record." In addition to event information, the purchase order/invoice number/DEA Form 222 serial number will also be recorded. These data fields are required for Schedule I and Schedule II type medications which are closely monitored by the US DEA. However, such information in the exemplary system is also made available for Schedule III, IV and V medications. Selecting the deposit menu causes the system to produce a screen 1212 shown in Figure 71 on the associated pharmacy terminal. Screen 1212 includes information required to be completed on a DEA Form 222. The exemplary

176

system operates to automatically fill in certain fields within the form. This is done based on

information stored in one or more data stores and includes the date and the DEA registration

number of the facility, the name of the supplier, supplier address and other. In the described

embodiment, in situations where an automated order tracking database is in connection with the

5   system, it may be possible to enter a DEA control number or P.O. number, and fields in the form

such as the supplier name and address, as well as the information concerning each of the items

received, may be automatically populated through operation of at least one computer system.

Alternatively, in situations where an automated ordering system is not included with the

names and addresses of suppliers which are stored in the system, a listing of suppliers may be

10   generated by selecting the "get supplier" icon on screen 1212. As a result of selecting this icon, a

list of suppliers may be presented, and by selecting on the particular supplier, the pertinent data

fields in the form may be populated. Alternatively, this information may be entered manually

through the pharmacy terminal.

In systems where the supply information is not populated automatically, there may be

15   listings of various medical items. Such listings may be presented by selection of the "get supply"

icon from screen 1212. This may cause a supply browser form such as screen 1214, shown in

Figure 72, to be presented. From screen 1214, a user is enabled to highlight a particular medical

item on the list. Selecting the "select" icon in screen 1214 causes the item information to be

populated with the corresponding information such as is shown in screen 1216 in Figure 73.

20   Once the information required has been populated, the user is then enabled in the

exemplary system to indicate where the deposit of the specified item is to be made. This is done

by selecting the "deposit" icon as shown in screen 1216. If insufficient information has been

177

populated in the record when the deposit icon is selected, a user will be prompted through one or more screen outputs to input additional information. Also, if at any time the user determines that incorrect information has been input and they wish to start over, they may either correct the information or clear the record by selection of a "cancel" icon.

If the "deposit" icon is selected after the data in the deposit form has been adequately populated, the system operates to cause a position screen 1218, shown in Figure 74, to be presented on the pharmacy terminal. The position window 1218 shows positions where the deposited medical item may be deposited. Selection of a supply position from the deposit screen 1218 causes supply positions holding the deposited medical item and assigned to the system to be retrieved. The information concerning each position, the minimum quantity, maximum quantity, current quantity and deposit quantity are shown. The exemplary system operates such that the system defaults to a current deposit position or other logical position to which items are to be first deposited. The system in the described embodiment operates to distribute the medications being deposited among the positions where the particular medications are stored. The first position will be filled first and then the second and so on. In the described embodiment, a user is enabled to change the default settings and allocate the medications deposited in other ways if desired.

At the bottom of the exemplary deposit screen 1218, fields are provided showing the system quantity prior to deposit and the deposit amount. When the deposited items have been allocated as desired, the user may select the "deposit" icon 1219 on screen 1218. Upon selecting the icon, a record of deposit is produced within the system and a deposit event is recorded in one or more data stores. In the described embodiment, the window will then automatically close

178

unless there is more than one (1) position in screen 1216; then the system will move to present a screen appropriate for the deposit of the next item. This process will then be repeated until all the items listed have been deposited.

Figure 75 shows screen 1210 with a withdrawal selection having been made. A withdrawal event is recorded when a medication is removed from the pharmacy such as in circumstances where the medication is to be transferred to a dispensing station. A withdrawal is assigned to the dispensing station that will be restocked with the removed medication. Such a withdrawal must be accounted for in the system through either a stocking event at the dispensing station or a return to the pharmacy event. If this does not occur a discrepancy is indicated by the system. In the described system, withdrawal events may be provided either by medication type for all dispensing stations or, alternatively, for storage locations associated with each display terminal. In screen 1220, shown in Figure 76, a selection has been indicated to withdraw medications by medical item type.

Selecting the "med/supply list" selection in screen 1220 causes a supply browser screen 1222, shown in Figure 77, to be displayed on the pharmacy terminal. Screen 1222 displays information concerning various forms of a plurality of medical items. The listing that is accessible on the terminal generally includes a list of items that are available to be taken from the pharmacy. A particular medical item can be selected from the listing by highlighting the particular type medication item. Thereafter, selecting the "select" button in screen 1222 causes a screen 1224, shown in Figure 78, to be displayed on the pharmacy terminal. Screen 1224 includes a listing of display terminals within the facility and their corresponding locations. Screen 1224 also includes information concerning current maximum and minimum quantities.

Screen 1224 also shows the amount or quantity that needs to be restocked to bring each storage location for the particular type of medical item selected to the minimum acceptable and maximum quantity. In the described embodiment, only display terminals with the selected supply at the associated dispensing station are displayed. It should be understood that while in this exemplary embodiment withdrawal quantities are associated with display terminals, in other embodiments withdrawals may be associated with storage cabinets, dispensers, nursing stations, wards or other items or areas within a facility.

In the described embodiment, a user is provided with selections concerning areas to be restocked. For example, as shown in screen 1224, the user is enabled to select all or various withdrawal groups. By selecting a subset of all withdrawal groups, a user is enabled to review inventory status information for the particular medical item type at those selected locations. Likewise, security buttons on the screen enables the user to select, for example, viewing information only those display terminal locations that are below minimum. For example, selecting the "below min" icon 1125 from screen 1224 causes a screen 1226, shown in Figure 79, to be produced. In screen 1226, only information related to those locations that are below the minimum are shown. The quantities to be added to bring those positions to minimum and maximum quantities are automatically populated. In response to an input selecting whether to restock to maximum or minimum quantity by selecting the appropriate icon the withdrawal quantity is presented. In screen 1226 the "restock to max quantity" has been selected which causes the appropriate "withdraw quantity" to be shown. In response to selecting the withdraw icon 1227 in screen 1226 one or more computers connected to the system records the taking of each withdraw quantity from the pharmacy for stocking at the corresponding display terminals.

180

A total quantity to withdraw is shown. Further, the information in the screen 1226 which shows the amount of remaining pharmacy inventory is automatically reduced by the withdrawal quantity indicated.

Returning to the discussion of screen 1224, a user is also enabled to set each of the

5   displayed positions to the maximum by selection of the "set to max" icon. This will cause the system to calculate for the displayed positions the withdrawal quantities that need to be taken from the pharmacy to bring those positions to the maximum quantities that can be stored therein. When this is done, the withdrawal quantity value will be included as a total of the items withdrawn and the pharmacy inventory (PV inventory) will be correspondingly reduced. It

10   should also be understood that a user may select each display terminal position and produce reports or instructions to selectively add quantities at each position as desired.

As shown in screen 1224, the exemplary system is also operative to provide a "positions" button. This allows a user to open a supply position screen showing positions for a selected display terminal and the particular type of medical item. Such a screen allows a user to view

15   each supply position. In this screen, the minimum quantity, maximum quantity, current quantity and restock to max quantity for the particular position, will be shown. The user will be able to provide an input to select the withdrawal quantity to be taken for restocking that particular position.

The user of the exemplary system indicates that a particular quantity or group of

20   quantities is going to be withdrawn from the pharmacy by selecting the "withdraw" icon from the particular interface screen. This causes one or more records to be produced and stored in the system concerning the items to be taken from storage in the pharmacy as well as the amount of

181

the supply to be stocked in the storage locations adjacent to each display terminal or other storage area. Such records may be used to produce one or more reports. The report can be used in the manner previously described to gather the medical items to be transported to each display terminal as well as used at the display terminal either in hard copy or electronic form for

5   purposes of restocking items in storage locations.

Figure 80 shows a screen 1228 which is similar to screen 1220 except that a selection is made to restock medications by each display terminal. Selecting the "by the display terminal" selection in screen 1228 causes a screen 1230, shown in Figure 81, to be output to the pharmacy terminal. Screen 1230 shows a listing of the various display terminals and their locations within

10   the facility of course in other embodiments other types of storage location designators other than display terminals such as areas, cabinets, wards or other area or device identifier may be used. In the exemplary embodiment a user is enabled to select a particular display terminal location. Selecting the "select" icon 1231 causes a screen 1232, shown in Figure 82, to be displayed. Screen 1232 presents information concerning the quantities of each of the medical items stored in

15   storage locations associated with the particular display terminal. A user is enabled to sort the display positions to view only those that are below the minimum by selection of a "below min" icon 1233. Alternatively, a user may select one (1) or more of the medical items by highlighting them using a mouse or other input device in connection with the pharmacy terminal, and determining the quantities on types of items that would need to be withdrawn from the pharmacy

20   to load such positions to the maximum by selection of a "set to max" icon as previously discussed. Alternatively, a user is enabled to view information concerning particular storage

positions associated with the display terminal by selecting a particular medical item and selecting the "positions" icon.

In screen 1232, a user is also enabled to manually set the withdrawal quantities to selected amounts as the user desires, either through manual inputs to an input device such as a keyboard or through selection of other icons as discussed. Once the user has selected the desired quantities to be withdrawn, the user is enabled to indicate the withdrawal by selection of the "withdrawal" icon 1235 as shown in screen 1234 in Figure 83. Selection of the withdrawal icon generates records in at least one data store related to the withdrawal of the particular item selected. As previously discussed, reports may be generated to be used for picking such items from the pharmacy and for preparing such items to be transported and restocked at the storage locations associated with the display terminal. Likewise, restocking reports may be generated in the ways previously discussed for use in connection with restocking at each display terminal. In addition labels or other machine readable indicia may be generated for application to medical items or for other purposes in a manner like that previously described.

Selection of the quarantine function is indicated in screen 1210 shown in Figure 84. Selection of the quarantine function causes the generation of a screen 1236 shown in Figure 85. Screen 1236 enables a user to select either a "quarantine" option or a "surrender" option. The quarantine option is related to the surrender of medical items to the DEA or other designated entity for purposes of destruction. The surrender option is related to the final removal of product from inventory. As shown in screen 1236, selecting the quarantine option causes a screen 1238, shown in Figure 86, to be displayed on the pharmacy terminal. Screen 1238 shows a listing of events that correspond to reasons for medical items to be quarantined. Such events which are

183

stored in at least one data store in the system include events related to recalls, expirations, unload

and retrieve events. As shown in screen 1238, each event, the type of item involved, the station

and user, quantity and status are each displayed. Through use of an input device, a user is

enabled to select the event corresponding to the medical items to be quarantined. In

5   embodiments of the invention data concerning such events may be input into at least one data

store in the pharmacy. Alternatively or in addition data concerning events may be input at other

locations such as at display terminals where a particular medication expires, is wasted or

otherwise identified as unsatisfactory.

Once a user has selected an event from screen 1238, the user may select a "select" icon

10   1239. This causes a window 1240 to be opened in overlying relation of screen 1238 as shown in

Figure 87. This enables the user to select a particular quarantine vault position for the items to

be quarantined.

Selecting the "quarantine" icon from window 1240 causes a screen 1242, shown in Figure

88, to be displayed. Screen 1242 includes information found in a DEA Form 41. Embodiments

15   of the invention may produce an electronic representation thereof. This information is populated

from data stored in a data store and which is shown generally in screen 1238. In addition, other

information is recovered from storage such as the facility's DEA number and address

information. The package number, which is the record number associated with the quarantine

activity, may be automatically assigned or otherwise assigned and manually input. From screen

20   1242, selecting the "save" icon 1243 causes data representative of the quarantine event to be

stored in the data store.

Figure 89 again shows screen 1210 in which the "external" option has been selected from a menu. Selecting the external option causes a screen 1244, shown in Figure 90, to be presented. Screen 1244 presents the user with the option of selecting either "borrow from" or "return borrowed" events, as well as "sell", "loan to" and "return loan" events.

5   The "borrow from" function corresponds to a deposit of a medication in the pharmacy storage that is being borrowed from another facility or other entity. When a replacement medication is removed from the pharmacy storage and sent back to the lending facility, a "return borrow" event will be input and associated with this borrow from event. Selecting the borrow from option from screen 1244 causes a screen, including a listing of supplies, to be generated such as those previously discussed. From this supply listing, a user is enabled to designate

10   such as those previously discussed. From this supply listing, a user is enabled to designate through one or more inputs the particular supply or supplies to be borrowed. Selecting a "select" button enables the user to select the highlighted supply to indicate a record and indicate that it is being borrowed.

Once a supply has been selected to be borrowed in this manner, a Form 222 entry

15   window, similar to that previously discussed, will be displayed. This screen is utilized such that the loaning facility will be required to be populated by the user under the "name of supplier" field. The control or purchase order field may be filled in by the user or it may be defaulted to indicate "borrow." The supply information will be populated by the system based on data from the screen in which the particular supply was selected. A quantity of the item borrowed will then

20   be input by the user and the date information may be automatically populated by the system. Thereafter, selecting a "continue" button on the screen will cause the borrow transaction to proceed much like a deposit transaction. This will cause a screen similar to screen 1218 to be

opened, allowing the user to allocate the amount borrowed. Instead of a "deposit" icon or button as shown in screen 1218, in the exemplary embodiment, a "borrow" icon or button is provided. Selecting the "borrow" button causes the borrow event to be recorded in one or more data stores such that it can be later associated with a return borrowed event.

5   Selecting the "return borrowed" function causes the exemplary system to operate to produce a list of events corresponding to items that were borrowed. A status is also provided related to the particular events to indicate which are open. A user is enabled to select the particular event to which the return borrowed activity corresponds.

In response to selecting a "select" button, further screens are presented to the user which

10   indicate a location in the pharmacy from which the "return borrowed" items are to be taken, as well as the necessary information to populate the field necessary to track the return of the borrowed item to the facility from which it was originally borrowed.

A "sell" option is also provided in the exemplary system. Selecting this function from a screen 1244 will open a record corresponding to a storage position, create a sell event and a Form

15   222 report will be created for Schedule I or II medications. In the exemplary embodiment the opening of a record related to a storage position causes the system to determine an available storage position for the item and to place information in the data store indicative of the medical item being stored in that position. The buying entity information and the medication sold may be manually input or automatically filled in through operation of the system depending on system

20   programming. Also, the supplier information can be automatically or manually filled out with the selling facility's information. This information can be transcribed to an official DEA Form 222. In operation of the system in response to selection of a sell function, a screen, including a

186

listing of supplies, is first provided from which a user may select a particular supply to be sold. Thereafter, a selection of an appropriate icon or button causes an electronic representation of DEA Form 222 to be produced. The fields in the form are populated either automatically, through manual inputs or through drop-down menus to complete the information necessary.

5   Thereafter, the data corresponding to the "sell" event is stored within a data store of the system to record the sales activity.

As shown in screen 1244, the described form of the system also includes a "loan" function option. This function in the described embodiment is operative to open a record corresponding to a storage position and create a loan event. When a replacement medication is received from the borrowing facility, the corresponding return loan event is created and associated with the loan event.

Again, in the described embodiment, selecting the loan event produces a listing of supplies available to be loaned. Highlighting the particular supply selects that supply for the loan operation. Thereafter, selecting an appropriate button on the screen opens a representation of a graphical DEA Form 222. Fields in the form are either populated automatically by the system, are populated through the use of drop-down menus or are filled in manually. Upon completion of the Form information, selection of an appropriate button corresponding to the loan operation, causes the data related thereto to be stored in the data store.

The return loan selection from screen 1244 allows a receiving facility to make a record of 20   the return of medications that were loaned to them. The return loan function displays a listing of loaned medications. The corresponding original loan event is selected through selection of appropriate icons on a series of screens in the described embodiment. A return loan event is

187

created and associated with the loan event and appropriate storage location within the pharmacy is also allocated for the return of the loaned medication.

Other functions may also be carried out through the described system. Selecting the "audit" option from screen 1210 causes a screen 1246, shown in Figure 91, to be displayed. Screen 1246 provides a user with three (3) selections. These selections include the ability to audit inventory of medications on hand. Alternatively, the user is enabled to select medication tracking which provides a balance sheet analysis of deposits and withdrawals. Finally, a user, from screen 1246, is enabled to select a discrepancy resolution to indicate the resolution of event discrepancies. Screen 1248 in Figure 92 shows the selection of the inventory function by a user. This causes a screen 1250, shown in Figure 93, to be displayed.

Screen 1250 includes a listing of medications in inventory. The medications are sorted by Schedule type. The user is enabled to select the medication by highlighting it using an input device such as a mouse in connection with the pharmacy terminal. Alternatively, while medications are shown in screen 1250 by DEA Schedule type, medications may be alternatively displayed in a different arrangement by selection of a "defined class" icon as an alternative to the DEA Schedule icon.

Once a particular medication has been selected by highlighting it as shown in screen 1252 in Figure 94, the user actuates the "select" button to produce an audit window 1254 overlying screen 1252 as shown in Figure 95. Audit window 1254 shows information on each of the storage locations for a particular medical item.

From window 1254, a user is enabled through an input device to select one (1) of the positions where the item is stored. Thereafter, selecting the "audit" icon opens a further window

188

1256 overlying screen 1252 which is shown in Figure 96. Window 1256 requests that a user

input the particular quantity of the item for the highlighted location. After the user inputs the

quantity, the user is enabled to select an "okay" icon 1257 to indicate that the particular storage

location has been checked. Thereafter, the system may automatically proceed to select other

5   storage locations for the item such that the user proceeds through a complete inventory for the

particular item. In this way, the system guides the user to conduct a complete inventory for

selected medical items.

In embodiments of the invention, the system may be configured to provide witness

verification for inventory activities. In such a case, both an original authorized user and a further

10   authorized user may be required to log onto the system for purposes of conducting an inventory.

In the described form of the invention, the system also enables performing a number of other

functions. These are carried out in a manner generally similar to those previously described

through the use of appropriate screen interfaces. For example, as shown in screen 1210, the user

is enabled to carry out a compound function. A compound event occurs when a medication is

15   withdrawn from the pharmacy inventory to be used to make a compound medication. The

medication withdrawn is associated via an event link key with a new compound medication when

the compound medication is deposited back into the pharmacy inventory, which is a return

compound event. In the operation of the described embodiment, the compound event involves

producing in response to a user selection, an output including a listing of supplies available for

20   compounding. Selection of an item to make a compound then produces a record in the system

that the particular item and the quantity indicated have been removed from inventory for

producing another medication.

The corresponding return compound function, which is selectable from screen 1210, operates by displaying to the user a listing of medications that were withdrawn for making compounds and which have not had resulting compounds deposited into the pharmacy inventory. The return compound event is created and linked in the system with the original compound event. A storage location is assigned by the system for the compound medication to be placed into storage. The pharmacist is also provided the option to enter any amount wasted and to link a waste event to the original compound event. In the exemplary embodiment a compound report can also be generated to verify that the amount of compound produced corresponds to the amount of material removed.

Another option which a user may select from screen 1210 is the return to pharmacy vault option. In the exemplary embodiment the pharmacy vault is a reference to the storage areas for items within the pharmacy operation. A return to the pharmacy may be due to a number of situations. These may include for example, unloading a dispenser, retrieving returned medications from a dispenser or having withdrawn more medications from the pharmacy than a dispenser can hold. The return to pharmacy function causes the pharmacy terminal to display a listing of display terminals. The user may then select the particular display terminal for or from which the items are being returned. The system then operates to present a list of medications that have been unloaded, retrieved and withdrawn and which have not been restocked for the selected display terminal. The user may then select the appropriate event and storage position and record the return pharmacy event which is linked in the system to the unload, retrieve or withdrawal event record.

A further option which may be selected from screen 1210 is a waste event. Medications may be wasted for many reasons. When a medication is wasted, it is linked by the system to an event that was generated when the medication was removed from the storage position. When medications are compounded, there may be some medication left over that may be wasted as

5   previously discussed. Also, a medication that is dropped and/or broken can be wasted. In the described system, selecting the waste option causes the system to generate a listing of events to which a waste activity may apply. These may include events related to withdrawal, compounds, expire, retrieve, unload, recall, loan or sell. An editable waste quantity field enables the user to specify the quantity wasted or to be wasted, and the event to which it should be linked. After

10   identifying the particular waste event and quantity, the user is enabled to select an appropriate button which causes the system to generate a waste window. As in the previously described examples, the user is prompted to provide the details of the waste event as well as the waste quantity. The user is enabled to select the reason for wasting the item from a drop-down list of reasons. In addition, if a witness is required, an appropriate witness login sequence is executed

15   which provides for a witnessing user to also observe and vouch for the waste event. Thereafter, the waste event is stored and linked to one (1) or more other events in the data store.

Another option that can be selected from screen 1210 by a user is the recall function. A recall function is associated with a situation where a manufacturer has found a problem with a medication and seeks to recall it. In such circumstances, all facilities must locate the medications

20   being recalled, remove them from their storage locations, dispensers and the pharmacy, and return the recalled items to the manufacturer. The recall function is operative to prompt for the quantity to be removed from the pharmacy storage. The recall function also creates a recall event

191

and electronically opens a record related to a storage position to allow the medication being

recalled to be removed from storage in the pharmacy.

In the described embodiment, the selection of the recall option causes a listing of supplies

to be provided to a user. The supplies include a listing of all medications that are stored in the

5   pharmacy. Selecting a medication provides the user with an option to review where the selected

medication is stored, both within the pharmacy as well as within the storage locations associated

with each display terminal. The user may thereafter be able to set the amounts to be recalled

from each of the storage locations. Storage locations will also be assigned as opened for the

recalled items. In addition, recalled items, when returned to the pharmacy, will preferably be

10   quarantined in accordance with the quarantine function previously described.

The described form of the invention also tracks for the expiration of medications. The

system also enables a user to select an expire function from screen 1210. The expire function

prompts a user to indicate a quantity to be removed from storage in the pharmacy and creates an

expire event. The system also operates to automatically open a record related to a storage

15   position to allow the expired medication to be removed from existing storage. For Schedule I

and II medications, the system also operates to activate the quarantine function. The user is also

alternatively enabled to operate the quarantine function in the case of an expire function for other

Schedule medications.

In the exemplary form of the invention, the system operates to provide a listing of

20   medications. Those medications listed can then be filtered for those that have an associated

expiration date which has been reached. The user is enabled to select those particular supplies

and in response to such inputs, an expire event is created. Thereafter, for certain medications,

192

through the automatic operation of the system, or alternatively in response to inputs from the

user, the quarantine function may be carried out in the manner previously described so as to

provide for storage of the expired medication under quarantine conditions pending delivery to an

appropriate entity for proper disposal.

5   In the described form of the invention, the medication tracking function carried out

through operation of one or more computers is operative to compare medications deposited and

withdrawn from the pharmacy to medications restocked and removed at each display terminal.

This function enables personnel in the facility to track medications in transition between the

pharmacy and dispensing stations. Event records are linked to other corresponding events.

10   Quantities associated with each event are used by the system to increase the reliability that all

medication amounts are accounted for. If there is not an exact match, a list of potential

discrepancy records will be displayed. Further, in exemplary embodiments of the invention,

medications may be further tracked in the manner previously described from the storage locations

adjacent to the display terminals to administration to the patients. In this way, medications are

15   tracked from the time they are received in a facility until administered to the patients. This

increases the capability of the system to account for medications and reduces the risk of improper

activities.

In the described form of the invention, the system operates to correlate various events

which occur in the pharmacy with other events so as to assure the proper disposition of the

20   medication and to account for activity. For example, borrow from events such as those described

herein are linked with the return borrow event. Likewise, a loan event is linked to a return loan

event. An event associated with withdrawing an item to compound is linked to the return of a

compound and a waste event associated with any amounts wasted.

Other linked events relate to withdrawal events being linked to a restocking event at a

display terminal and/or a return event returning medications to the pharmacy. An expiration

5   event associated with a medication is correlated with a quarantine event and a waste event.

Similarly, a recall event is correlated with a quarantine and/or a waste event. Further events such

as unloading storage locations at a display terminal or retrieving or expiring medical items from

storage locations at a display terminal, are linked in the system with a return event to the

pharmacy and a quarantine event associated with storing the returned medical items in the

10   pharmacy. Also, in embodiments of the invention, medications that are received as unit packages

may be reconfigured similar to that done in connection with a compounding event, but in this

case into different package sizes with possible corresponding waste events. Of course these

events are exemplary, and in other embodiments of the invention, other events may be tracked

and linked.

15   It should further be understood that the nature of the terminals and user interfaces

presented in the described embodiment are exemplary. In other embodiments, other types of

terminals and interfaces may be used.

It should further be understood that in the exemplary form of the invention, the pharmacy

may also carry out additional purchasing activities. These may include purchasing medications

20   from remote suppliers electronically through connected networks, and concluding order

processes for the particular items to be purchased. In addition, as previously discussed, the

system may be operative to sell medications to other facilities who are in need thereof. This may

194

be accomplished when desired, by hosting on a website or other externally accessible location, information concerning medications available for sale to authorized persons. This may include, for example, excess quantities of items that the facility may have inadvertently purchased or alternatively may have on hand as a result of items previously loaned being returned. Such items may be posted for purchase by other medical providers or by a supplier or distributor thereof. Such supplies may be posted with a particular standardized price or, alternatively, online auction type procedures may be used under which medical items are sold to the highest bidder within a specified time period.

Such capabilities also enable a medical facility to request or bid in an auction process for specified medical items. This enables other medical facilities who may have excessive amounts of a particular item on hand to resell such items to facilities who are in need and to avoid a loss that might otherwise occur with an expiration event. Such arrangements further have the capability of minimizing price discrepancies that may result in various geographic areas due to differences in supply in demand.

As discussed previously, the exemplary embodiment of the present invention is operative to track medications, from the point of receipt from the supplier to the point where the medication is administered, wasted, surrendered, sold or recalled. All medications that are deposited in the pharmacy using the present invention will be tracked in this manner regardless of their schedule. Medications are ordered from suppliers and these orders are tracked through a purchasing system. The U.S. Drug Enforcement Agency (DEA) monitors the purchases of schedule (I-V) medications. Some states have an additional medication schedule, for example Schedule-VI, which is required to be controlled in those states. For Schedule-I & Schedule-II

medications, the purchaser must complete the purchaser section of DEA Form-222 when

ordering. The supplier must complete the remaining section of the form. Form-222 is a

numbered, multiple copy form. Two copies of this form are intended to be presented to the

supplier at the time the order is placed, and a copy is filed by the purchasing facility. For

5   medications that are not Schedule-I or Schedule-II, a facility's Purchase Order form is generally

used.

When the supplier delivers medications, they become the responsibility of the pharmacy.

All Schedule medications must be delivered to and checked by the pharmacy. Non-schedule

medications are either delivered to the pharmacy or delivered directly from the supplier to the

10   appropriate dispensing station. A completed Form-222 is provided with all Schedule I &

Schedule II medications. The completed form is used for delivery verification and then filed.

Sometimes medications become unusable, generally because their last usable date has expired or

the medication has become contaminated. Schedule-I & Schedule-II medications that are

unusable must be surrendered to the DEA. As discussed previously, these medications must be

15   stored and quarantined in the pharmacy until they are surrendered. These items are generally

surrendered to a third party agency contracted by the facility. Surrendered inventory is

considered to be part of a facility's inventory until a notice of destruction has been received from

the third party agency. Other medications, including schedules III, IV and V are contracted to a

third party agency for destruction or disposed of immediately, usually with a witness.

20   The following process flows represent exemplary steps for tracking the movement of

medications with further exemplary embodiments of the present invention. Generally,

an order is used to start the process for acquiring medications from suppliers. Schedule I and II

medications must be ordered using DEA Form-222. An inventory interface can be used with the

exemplary system to electronically order medications from suppliers or a "Restock Cabinet"

report can be generated by the system which can be faxed to suppliers. Both the interface and the

5   report output a list, by storage device (including virtual storage) of all medication storage

positions, the current, minimum, maximum and recommended restock quantities. The

recommended restock value is the maximum quantity less the current quantity. For facilities that

do not have electronic supplier interfaces or must order in specific quantities, the listing will be

an aid for manually completing a purchase order form.

10   Medications are deposited into a pharmacy, usually by a pharmacist or pharmacy

technician. The exemplary embodiment of the present invention is operative to create the

"deposit" event record that includes information about the medication, the storage compartment,

the date and time of the deposit, and an identity of the pharmacist or operator performing the

deposit. Additional data that may be recorded with the deposit event record include the P.O.

15   Number, Invoice Number and DEA Form-222 serial number. These data fields are also available

for Schedule III-V medications. Once the deposit event record has been created, the exemplary

embodiment of the present invention is operative to generate a deposit verification report which

includes all or portions of the data stored with the deposit event record. The deposit verification

report may then be compared against the Form-222 medication list for Schedule-I & Schedule-II

20   medications and against a bill of lading for non-scheduled medications.

Figure 97 shows an example of an alternative exemplary deposit form screen 1300. The

exemplary screen 1330 of Figure 97 is similar to the deposit screen 1212 of Figure 71 and is

197

organized to have the appearance of a DEA-222 form. Screen 1300 is operative to generate and update deposit event records in the data store.

The exemplary deposit form screen 1300 includes a plurality of medical item lines 1328. Each medical item line includes a line number 1324 and a deposited checkbox 1326. The line number is generated automatically by the system. The deposited checkbox field becomes checked when a corresponding medical items for the medical item line is deposited. Each medical item line includes the name of the medical item 1310 and the following editable fields: number of packages 1304, size of package 1306, and quantity 1308. The number of packages field 1304 specifies the number of individual boxes, packets, or other package groupings deposited for the particular type of medical item being deposited. The size of package field 1306 corresponds to the number of medical items in a package. The quantity field 1308 corresponds to the actual number of items being deposited. The quantity field 1308 may be entered by an operator of the system. In addition, the exemplary system is operative to automatically calculate the value for the quantity field 1308 by multiplying the value associated with number of packages field 1304 by the value associated with the size of package field 1306.

The exemplary deposit screen 1300 further includes a name of supplier drop down list box 1302. The name of supplier drop down list box 1302 is populated with facility names from an external facility table of the data store. When a name of a supplier is selected from the supplier name field list box 1302, the exemplary screen 1300 is operative to automatically populate supplier fields 1301. These suppler fields 1301 include street address 1316, city and state 1318, date 1320, and the supplier's DEA registration number 1322.

198

The exemplary deposit screen 1300 also includes a form number field 1312. The form number field 1312 displays a value corresponding to the control number or serial number of a form such as the DEA-222 form. For non-scheduled medications a P.O. number by be inserted into the form number field 1312.

When deposit form screen 1300 is first opened, an operator is operative to input a form number in the form number field 1312 for an existing or new form. When a DEA Control Number is entered, or PO Number for non-scheduled medications is entered in the form number field 1322, and a medication is actually deposited, the following will be performed: 1) If the form number already exists, a external facility key will be updated in the data store; or 2) If the form number does not exist, a new form record will be inserted into a form table of the data store. For each new form record, the system will internally generate a unique form key. Information entered in screen 1300 is saved in the form record of the data store in association with the unique form key.

If the user enters an existing Control/P.O. Number, in the form number field 1310 then all associated deposit events (up to ten) will be displayed in the medical item lines 1328. Any un-deposited medical items (one per line) will be moved to the end of the list. If all existing events plus all un-deposited line items combine to be more than 10, the user will be informed, but will be allowed to continue. If the user chooses not to continue, then the Control/P.O. Number will be set to null.

In the exemplary embodiment, when a user enters a non-existing Control/P.O. Number, while events associated with an existing form are displayed, then all of the associated events will be removed from the line item detail area. Any un-associated medical items (one per line) will be

199

moved to the beginning of the list. This described exemplary embodiment further includes a menu option 'Change Form Number' which is operative to change the form number saved in the form table for the current form to the value entered in the form number field 1312.

When a new form record is created, an operator is operative to select a supplier from the supplier drop down list box 1302. To populate the medical item lines 1328 with the name of a medical item 1310, the operator may click or otherwise activate the supply button 1314. Clicking the supply button 1314 causes the exemplary system to open a supply browser screen which lists medical items for insertion onto form 1300. In the exemplary embodiment, the supply button 1314 will not allow access to the supply browser screen unless one of the medical item lines 1328 is selected.

In the exemplary embodiment of the present invention, the supply browser screen includes a list of all supplies in the pharmacy. Figure 98 shows an exemplary embodiment of a supply browser screen 1350 which is similar to screen 1214 of Figure 72. This screen provides the following information: supply trade name, supply generic name, item code, NDC code, form, size, size units, strength, supply system quantity, DEA schedule and customer defined class. The supply browser screen 1350 includes a select button 1352 which places the highlighted medical item 1354 in a medical item line 1328 of the deposit form screen 1300 at the current row when the supply browser screen was opened.

The exemplary deposit form screen 1300 includes a deposit button 1330. When this button is clicked, the following checks are made: 1) Current line item of the deposit form screen 1300 must be populated with a supply; 2) A quantity must be provided (either by hand or

200

calculated from the package fields); and 3) If the supply is a schedule 1 or 2, a Control Number must be provided

If the required checks are confirmed, a supply position browser screen will be displayed. Figure 99 shows an exemplary embodiment of a supply position browser screen 1360 which is similar to screen 1216 of Figure 73. This screen displays all supply positions assigned to the system. The information displayed for each supply position includes: position, minimum quantity, maximum quantity, current quantity and deposit quantity.

The deposit quantity field 1362 is an editable field (on each row), defaulted to the quantity from the deposit form screen 1300. The select position, by default, will be the current dispensing position. If the current dispensing position is not set, logical position will be used. The user may select a supply position, and modify the quantity to be deposited. Only one supply position may be selected for depositing at a time. In cases where multiple positions are provided, the exemplary system is operative to distribute the items based on their current and maximum quantities such that the first position will be filled up, then the second position, and continuing to the last position. The bottom of the exemplary supply position browser screen 1360 includes display only fields 1364 for system quantity and deposit quantity. The deposit quantity field corresponds to the initial total deposit value from the deposit form screen.

The exemplary supply position browser screen 1362 further includes a deposit button 1366 which initiates the deposit process. Before depositing, if deposit form screen 1300 has a Control/P.O. Number entered, then one of two steps occurs: (1) If the form number is new, then a form record is inserted in the form table of the data store, or (2) if the form number already exists, and form information has been changed, then the form record of the form table is updated.

201

In the exemplary embodiment, the form table management is handled by the deposit form screen 1300 responsive to the information provided in the supply position browser screen 1360. After depositing, the deposit quantity field 1362 for the current position will be set to zero, and the current quantity field 1368 will be updated with the deposited quantity value. After depositing, the screen will automatically close, unless there is more than one position in the browser, and one of the other positions has a non-zero quantity.

For each deposit, a deposit event record is generated and saved in the data store. Each deposit event record is associated with a form key, a form type, and a form date. For deposit event records corresponding to a DEA-222 form, the name of item field 1310 and quantity field 1308 are required before a deposit event record will be created in the data store. If the supply to be deposited is a scheduled medication, then the DEA Control Number is also required to be entered in the form number field 1312.

When a medication is removed from the pharmacy to be transferred to a dispensing station, a withdraw event is recorded in the data store. A withdraw event is associated with the dispensing station that will be restocked with the medication. Each withdraw event must be accounted for through either a restock at a dispensing station (stocked event) or a return back into the pharmacy (return pharmacy event). As discussed previously, exemplary embodiments of the present invention enable withdrawing 'by medication' and 'by display terminal'.

A withdraw by medication process is included as a menu option in the described exemplary embodiment of the present invention. Selecting a 'by medication' menu option will open a supply browser screen which is similar to the supply browser screen 1350 shown in Figure 98. The supply browser screen provides a list of all supplies that are assigned to cabinets

202

that reside within the pharmacy location. Once a supply has been selected, a display terminal

browser will be opened. Figure 100 shows an exemplary embodiment of a display terminal

browser screen 1370 which is similar to screen 1224 shown in Figure 78. The display terminal

browser screen 1370 includes a listing of terminals 1374 which have the particular medical item

5   selected with the preceding supply browser screen . Information displayed by screen 1370

includes: display terminal (node name), current quantity, minimum quantity, maximum quantity,

restock to max quantity, and withdraw quantity. All current, minimum, and maximum quantity

values will reflect the sum of all of the display terminal's supply positions with the selected

medical item assigned. The exemplary display terminal browser screen 1370 includes a

10   withdraw group list box 1372. The values in the list box 1372 include the item of 'All' (default

value). When the 'All' item is selected, all terminals from all groups will be displayed in the

display terminal browser screen 1370. If a particular withdraw group is selected in the list box

1372, then display terminal list 1374 will be filtered to include only those terminals assigned to

the selected group.

15   The withdraw quantity field 1376 is an editable field on each row of the display terminal

list 1374. For the selected display terminal, the user will enter the quantity to be withdrawn. In

the exemplary embodiment, multiple display terminal withdraw quantities may be specified, and

withdrawn all at one time. The exemplary display terminal browser screen 1370 includes

information about the medical item 1378 that was selected with the supply browser. In addition

20   screen 1370 includes a withdraw total field 1386 which indicates the total quantity to be

withdrawn. The withdraw total field 1386 is be calculated based on quantity updates within the

display terminal list 1374. The exemplary display terminal browser screen 1370 may also

include a further supply quantity field which indicates the quantity of the supply that can be withdrawn.

The exemplary display terminal browser screen 1370 includes a withdraw command button 1380 which is operative to initiate the Withdraw process. If multiple display terminals in the list 1374 have a quantity associated with them to withdraw, then each display terminal will have a separate withdraw event written to the data store when the withdraw button 1380 is clicked. Also when withdrawing, the supply position(s) for the display terminal will be opened.

As discussed previously an exemplary display terminal browser screen may include a below min button 1382 or menu option. This below min button 1382 enables the user to filter the terminal list 1374 to view display terminals which have a supply position with a current quantity less than its minimum quantity. In addition the described exemplary display terminal browser screen 1370 may include a positions button 1384 or menu option which is operative to open a supply position browser, showing positions for the selected display terminal and supply.

Figure 101 shows an example of a supply position browser 1390 which is opened by the system in response to the clicking of the positions button 1384. Screen 1390 includes fields which display for each position: position description, minimum quantity, maximum quantity, current quantity and restock to max quantity. Screen 1390 further includes a restock display terminal to max quantity field 1392 which indicates the quantity of the supply that will restock all of the display terminal's positions to their maximum quantities. Screen 1390 further includes an editable withdraw quantity field 1394. An operator may enter the quantity to be withdrawn for the display terminal in field 1394. In this described embodiment, the initial value of field 1394 is obtained from the display terminal browser screen 1370. Screen 1390 also includes an accept

204

button 1396, which when clicked closes screen 1390 and updates the selected withdraw quantity field 1376 of the display terminal browser screen 1370 to include the entered withdraw quantity 1392 of Screen 1390.

Further alternative exemplary embodiments of the display terminal browser screen 1370 may include a paper track command button which allows a user to withdraw medical items which will not be assigned to a display terminal, but will be tracked via a control sheet to a non-automated nursing station. Clicking the paper track button will ignore any selected display terminal and generate the control sheet. If any display terminal quantities were updated, the user will be asked if he/she is sure of the action. A paper tracking screen will then be displayed for the user to enter required information.

Figure 102 shows an example of a paper track screen 1400. The screen includes a withdraw quantity field 1402 for entry of the number of medical items to withdraw. The medical items are of the type previously selected with the supply browser screen 1350. The exemplary paper track screen 1400 further includes a withdraw button 1402 which when clicked is operative to create a withdraw event corresponding to a paper tracked event. The paper tracked event causes the system to generate and print a control sheet and/or proof of use sheet. In one exemplary embodiment, the control sheet may include the trade name, generic name, size, units, strength, and/or form of the medical item.

In an alternative exemplary embodiment fo the present invention, the paper track button may be located in the supply browser screen used to select a medical item for a withdraw. Clicking the paper track button from this screen is operative to generate a paper track withdraw screen which provides a plurality of customizable fields which will be printed on the control

205

sheet. The paper track withdraw screen may include an entry field for paper track number or control number. The pharmacist may insert into the control number field an identification number associated with proof of use sheets which transfer narcotics from the pharmacy to nursing floors.

5   If no paper track number is provided, the exemplary system is operative to automatically generate a unique number. This described alternative embodiment of the paper track withdraw screen may further include a drop down list of paper track locations where paper tracked medication will be sent. Clicking of a withdraw button in the screen is operative to verify the quantity to be withdrawn, create the withdraw event in the data store, and if appropriate open a

10   storage device. This described alternative paper track screen may further include a check box which indicates that the withdraw will not be returned.

The exemplary system is operative to initiate the printing of multiple copies of the control sheets responsive to the information selected from the supply browser screen and the paper track screen. One control sheet may be kept by the pharmacist, while the second control sheet is for

15   the nursing floor. In addition, the described paper track screen may also include a check box which indicates that control sheets are not to be printed.

In this described exemplary embodiment, the printed control sheets include: control number, item trade name, item generic name, item size, size units, item strength, item form, DEA Schedule, expiration date, quantity withdrawn, data and time of withdraw, identify of operator,

20   and a paper track location. The exemplary control sheet may further include blank lines for entering: the identify of the receiving party, the date of transfer, identity of person returning items

to pharmacy; the quantity returned, the identity of the person with the pharmacy that received the items; and the date items were returned.

In the exemplary embodiment, the system generates one or more lines on the control sheet which are used to record information concerning the administration of the controlled medication. The number of lines generated by the system corresponds to the entered quantity withdraw amount. Each administration line printed on the control sheet includes blank boxes for entering: the date, time, patient name, physician name, give dose, waste, name of person administering dose, and the name of a witness if there is waste.

In this described embodiment, the system further includes a paper track button or menu option that may be selected when withdrawn items being tracked by paper are returned. Selecting such an option opens an event browser screen that lists withdraw events saved in the data store of the system. An operator may select the withdraw event which corresponds to the control sheet and medical items being returned. When a listed withdraw event is selected, the exemplary system is operative to open one or more browser screens which enable the operator to select the position to return the items and enter the quantity being returned. After the position and quantity information has been received, the exemplary system is operative to generate a return to pharmacy event which is saved in the data store in association with the selected paper track withdraw event.

A withdraw by display terminal is included as a menu option in the described exemplary embodiment of the present invention. This menu option may be used to withdraw all medications for a single, selected display terminal. In this described exemplary embodiment,

selecting a by display terminal menu option will open the display terminal browser screen 1410 such as is shown in Figure 103. Screen 1410 is similar to screen 1230 of Figure 81.

Once a display terminal has been selected from screen 1410, the exemplary embodiment of the present invention is operative to open a supply browser screen 1420 as shown in Figure 104. Screen 104 is similar to screen 1232 of Figure 82. Here the operator may view the medical items associated with the display terminal selected with the display terminal browser screen 1410. In addition the supply browser screen 1420 includes a withdraw quantity field 1422 for each displayed medical item. An operator may enter a quantity to withdrawal in field 1422 for each medical item listed. The exemplary supply browser screen 1420 further includes a positions button 1424, which when clicked opens a screen which displays positions corresponding to the selected medical item for the selected display terminal. When the withdraw button 1426 of screen 1420 is clicked, the exemplary system is operative to create one or more withdraw events in the data store and is operative to open the corresponding supply positions of the selected display terminal.

In this described exemplary embodiment, medications assigned to the pharmacy will be displayed by generic name and trade name. Their current quantities in the vault will not be displayed, to ensure that actual counts are done when a pharmacy count remaining verification is required. As discussed previously, the exemplary system is operative to track a plurality of different transactions or functions with medical items. These transactions or functions include: a borrow function, load function, sell function, unit package function, compound function, recall function, expire pharmacy function, quarantine function, and inventory function.

208

As discussed previously, the exemplary borrow function is a deposit of a medication that

is being borrowed from another facility. When depositing, the supply position selected will be

opened and a borrow event will be created. When a replacement medication is removed from the

vault to send back to the lending facility, a return borrow event will be created and associated

5   with this borrow event. The exemplary loan function is operative to open a storage position and

create a loan event. When a replacement medication is received from the borrowing facility, a

return loan event will be associated with this loan event. The exemplary sell function will open a

storage position and create a sell event. For schedule 1 or 2 medications a Form-222 report will

also be generated.

10   The exemplary unit package function generates a unit package event and opens one or

more positions. The unit package function is selected when a medication is removed from the

pharmacy inventory to be separated into unit dose packages of this medication. This medication

will be associated with a return unit package medications when they are deposited into the

pharmacy inventory. The exemplary compound function opens one or more positions and

15   generates a compound event. The compound function is selected when medication is to be

withdrawn from the pharmacy inventory to be used to make a compound medication. This

medication will be associated with the new compound medication and a return compound event

will be generated when the compound medication is deposited back into the pharmacy inventory.

As discussed previously, when a manufacturer finds a problem with a medication, the

20   manufacturer will recall it. All facilities must locate the medications being recalled, remove

them from their dispensers and the pharmacy and return them to the manufacturer. The

exemplary recall function prompts for the quantity to remove from the vault, creates a recall

event in the data store and opens the storage position to allow the medication to be removed from the vault. If the supply is a Schedule 1 or 2 medication, then the exemplary quarantine function is initiated, starting at a quarantine screen. Figure 105 shows an example of an exemplary quarantine screen 1430 which is similar in appearance to a DEA Form-41 (Registrants Inventory of Drugs Surrendered) . Screen 1430 is also similar to screen 1242 of Figure 88. If the medical item is not a Schedule 1 or 2, then a message box will be displayed to the user asking if the medication(s) are to be Quarantined. If 'Yes' is chosen, then the quarantine function is initiated, starting at the quarantine screen 1430.

In addition to removing recalled medication, expired medication must also be removed from the vault. The exemplary expire pharmacy function prompts for the quantity to be removed from the vault, creates an expire pharmacy event in the data store, and opens the storage position to allow the medication to be removed from the vault. For Schedule-I & Schedule II medications, it automatically activates the quarantine function. The facility can also elect to automatically quarantine schedule III-V medications. If the supply is not a Schedule 1 or 2, then a message box will be displayed to the user asking if the medication(s) are to be quarantined. If 'Yes' is chosen, then the quarantine function is initiated, starting at a quarantine screen 1430.

In the exemplary embodiment the quarantine function may also be selected from a menu option. Doing so will open an event browser screen. Figure 106 shows an exemplary event browser screen 1440. The event browser includes a listing 1442 of medical items that are associated with events. Each line of the listing 1442 includes information fields such as: event date, supply trade name, supply generic name, size, size units, strength, station, user name, event status, and event quantity. The listing 1442 includes events that are available to be quarantined,

210

including: expire pharmacy events, recall pharmacy events, unload events, and retrieve events. Once an event is selected, the previously described quarantine screen 1430 is opened by clicking the select button 1444. When quarantining a medicine, no supply positions are opened, and one quarantine event will be created.

5   In the exemplary embodiment, an inventory function may only be performed by a pharmacist which has the audit access right and the access right for the schedule of the medication selected on a medication pick list. In addition a witness is required for the audit function. As discussed previously, the witness will be prompted to login, and the audit function will verify that this user has the witness right. If access is granted, the storage position is opened

10   and the pharmacist is prompted for a count of this medication. If the pharmacist's count and system count don't match, then the pharmacist is prompted to recount and enter the count again. If the pharmacist count still doesn't match the system count, the system count is changed to the pharmacist's count and an audit event is marked as a discrepancy. The pharmacist can also update the expiration date for this supply position. An audit event that includes the medication,

15   pharmacist, witness (if required), audit date and time, supply position and quantity is created. Also, the audit date for this medication is set to the current date. The capability for the pharmacist to enter text information for discrepancies is provided within the discrepancy resolution function. When auditing, one position will be opened and one audit event will be created (unless the user cancels).

20   The need to return medical items to the pharmacy may occur due to: 1) unloading a dispenser, 2) retrieving returned medications from a dispenser, or 3) withdrawing more medications from the pharmacy than a dispenser can hold. The exemplary embodiment of the

211

present invention includes a return pharmacy function as a menu option. When this function is

selected by an operator, a display terminal browser screen is opened to enable the operator to

select the particular display terminal that is returning the medication. The return pharmacy

function will also present an event browser screen which lists medications that have been

5   unloaded, retrieved and withdrawn and have not been restocked for the selected display terminal.

The pharmacist may then select the appropriate event and storage position, so that the system

may record a return pharmacy event in the data store which is linked to the related unload,

retrieve or withdraw event record.   For returning medications that were withdrawn via the paper

track function, the exemplary display terminal browser may include a paper track button.

10   Selecting the paper track button opens the event browser which displays paper track withdraw

events that may be returned against.

The exemplary return borrow function allows the pharmacy to return medications that

were borrowed from an external facility. The return borrow function displays a event browser

screen which lists borrow events. After a borrow event is selected, a return borrow event is

15   created and associated with the selected borrow event. The storage location is opened to allow

the medication to be taken from the vault. This medication is then sent back to the lending

facility.

The exemplary return loan function allows a borrowing facility to return medications that

were loaned to them. The return loan function displays an event browser which lists load events.

20   The original loan event may be selected by an operator. The load function further prompts the

operator to enter a position and the quantity of the medical item to be returned. The load

function is operative to create a return loan event which is associated with the selected loan

212

event. The exemplary load function then causes the storage location to be opened to allow the medication to be put into the vault.

The exemplary return compound function is operative to open an event browser which displays a listing of return compound events for medications that were withdrawn for compounding but have not had the resulting compounds deposited into the pharmacy inventory. The return compound function creates a return compound event which is stored in the data store in association with the selected compound event. The storage location is opened to allow the medications to be put into the vault. The pharmacist will also be able to enter the amount wasted, if any. The waste event will also be linked to the original compound event. The exemplary system is operative to generate a compound report which can be used to verify that the appropriate quantity of compound medications was created.

The exemplary surrender function is operative to open a form-41 screen which lists quarantine events with quarantine package numbers that have not been surrendered to the DEA. The pharmacist may select a package to be surrendered and a surrender event is created and associated with the quarantine event for this package number. The surrender function is then operative to causes the storage position for the quarantine vault, for this package, to be opened. The surrender function is further operative to print the Form-41 form. The entire contents documented on a Form-41 may then be surrendered together with the form.

The exemplary medication tracking function compares the medications deposited and withdrawn from the pharmacy to the medications restocked and removed at the display terminal. This function is operative to help the pharmacist keep track of medications in transition between the pharmacy and dispensing stations. Event records are linked by event keys fields and link

keys fields in the data store. The event quantities associated with the events are used to ensure all medication amounts are accounted for. If there is not an exact match, a list of potential discrepancy records will be displayed. Since there may be a considerable amount of time while medications are in transit between the pharmacy and the dispensers, these potential discrepancies may not actually be discrepancies. The ability for a pharmacist to convert one, many, or all of these potential discrepancies to actual discrepancy records will be provided.

The exemplary embodiment of the present invention includes a medication tracking function as a menu option which is operative to open an event browser screen which lists events stored in the data store. Figure 107 shows an exemplary medication tracking event browser screen 1460 which is used to display events for medication tracking. The exemplary event browser screen 1460 includes information about the events such as: supply trade name, supply generic name, size, size units, event date, event quantity, and status description. The exemplary embodiment of screen 1460 may further include a computed column which displays an original event quantity minus the sum of linked event quantities.

In the exemplary embodiment displayed events correspond to either original events or linked events. The original events will display all of their information, and are the events to which later events are linked. All events linked to the original event will be displayed immediately below the original event, but will suppress the supply name to indicate that it is linked to the event above it. In an alternative exemplary embodiment, the original and linked events may be organized as a tree view structure with the linked events being displayed as sub-branches beneath the original events.

The exemplary medication tracking event browser screen 1460 is operative to retrieve events with event statuses corresponding: borrow, loan, compound, unit package, withdraw, expire pharmacy, recall pharmacy, unload display terminal, retrieve display terminal, and expire display terminal. Figure 108 shows a table 1470 which displays exemplary original events 1472 and their corresponding linked events 1474.

The exemplary event browser screen 1460 includes a set of option boxes 1462 which are operative to cause the event browser to filter the listing 1464 of events. As shown in Figure 109, when an in-transit option box 1502 is selected, the exemplary event browser screen 1460 is operative to display all events associated with medical items that are in transition between the pharmacy and dispensing stations.

In the exemplary embodiment of the event browser screen 1460 and other browser screens of the present invention, the headings of columns are operative as sort buttons. Consequently, an operator is enabled to sort events in the listing 1464 by clicking the individual headings 1466 for the events in listing 1464. For example to sort events by date, the date heading 1468 can be clicked. By clicking the date heading 1468 a further time, the exemplary event browser screen 1460 is operative to sort events by date in the reverse order.

In the exemplary embodiment, sorts build on each other. As a result, when a second column heading is clicked, the exemplary event browser screen 1460 is operative to first sort the events by the second column heading and then by the previously clicked heading. For example if the date heading is clicked first and the generic name heading 169 is clicked second, the exemplary event browser screen is operative to sort events first by generic name and then by

215

date. When each addition heading is clicked, the exemplary event browser screen is operative to

sort events first by the additionally clicked headings and then by each heading clicked previously.

As shown in Figure 110, when a to/from display terminal option box 1504 is selected, the

exemplary event browser screen 1460 is operative to filter the listing 1464 to display in-transit

events which are associated with a display terminal. In the exemplary embodiment such events

may correspond to withdraws events associated with display terminals; unloaded, expired, and

retrieved medication events associated with a display terminal; and return to pharmacy events

which are linked to any of these described events.

As shown in Figure 111, when a paper track option box 1506 is selected, the exemplary

browser screen 1460 is operative to filter the listing 1464 to display paper track withdraw events

which have not been returned. As shown in Figure 112, when a Expire/Recall option box 1508 is

selected, the exemplary browser screen 1460 is operative to filter the listing 1464 to display

expire and recall events which have not been quarantined or wasted. As shown in Figure 113,

when a compound/unit package option box 1510 is selected, the exemplary browser screen 1460

is operative to filter the listing 1464 to display withdraw bulk item and withdraw ingredient

events which have not been deposited via the deposit unit package function and deposit

compound functions respectfully. As shown in Figure 114, when an external facility option box

1512 is selected, the exemplary browser screen 1460 is operative to filter the listing 1464 to

display loan and borrow events which have not been returned.

Of the in-transit events listed in the event browser, only few of the events may be an

indication of a discrepancy. As shown in Figure 115, to filter out possible discrepancies, the

exemplary event browser screen 1460 includes a possible discrepancy option box 1514.

Selection of this option causes the event browser screen 1460 to display those in-transit events which are beyond a specified discrepancy time internal. As a result, events will be displayed where the original event quantity is greater than the sum of its linked events, and the event date is beyond the discrepancy time interval.

5   The exemplary event browser screen 1460 includes a discrepancy button 1520. This button enables the operator to mark the selected event as discrepant. A message box will verify that the event should be marked as discrepant. If the user answers 'yes', then a discrepancy flag associated with the event is set to 'Y', and a discrepancy log record is generated.

In the exemplary embodiment discrepancy events may also be flagged in a number of

10   other ways. For example, during a dispense from a drawer module, the user may be required to count the remaining medications within a compartment before closing the drawer. If the user's count differs from the system maintained count, a flag is set within the event record indicating that there is a discrepancy.

·   In addition a discrepancy may be flagged during a dispense from a unit dose module,

15   when the quantity requested by the user is not the actual quantity dispensed. This may occur if too many or too few medications are dispensed due to medications that stick together or if dispensing gates are not adjusted properly. The user has the option to choose a discrepancy button at the pharmacy to indicate that the counts differ, thus creating a discrepancy. Also, during the deposit process, when the system maintained count differs from the count entered by

20   the user during the deposit process, a discrepancy may be flagged.

The exemplary system is operative to generate a discrepancy report which details each discrepant event and the previous accesses to the respective supply position. A discrepancy may

217

be resolved through a discrepancy resolution function of the exemplary embodiment of the present invention. When an event count is resolved an entry will be written to a discrepancy log database table. In the exemplary embodiment, the discrepancy resolution function is accessed through a menu option. This function opens a discrepancy resolution screen which enables an operator to mark the discrepancy as resolved, and enter a text describing the resolution for the discrepancy. In addition discrepancies may be auto resolved by the exemplary system if two consecutive user counts indicate that a miscount has occurred on a drawer or virtual compartment.

As discussed previously, the exemplary embodiment of the present invention includes a waste function. Medications may be wasted for many reasons. When a medication is wasted it will be linked to an event that was generated when the medical item was removed from a storage position. When medications are compounded, there may be some of the medication left over that will be wasted. Also, a medication that is dropped and broken must be wasted.

In the exemplary embodiment the waste function may be accessed from a menu option Selecting the waste function opens an event browser screen. The event browser screen is operative to display events with statues corresponding to withdraw, compound, unit package, expire, expire pharmacy, retrieve, unload, recall pharmacy, loan and sell. Each event includes an editable waste quantity field which enables an operator to select an event and specify the quantity wasted, or to be wasted, on the same line as the selected event. The waste function is further operative to open a waste screen which prompts the operator to enter the waste quantity and the waste reason. The exemplary waist function generates a waste pharmacy event which is saved in the data store in association with the original event selected with the event browser.

218

If the medical item being wasted has its witness required flag set to 'Y', then a witness will be required enter login information to complete the waist function and generate of a waist event.

As can be appreciated from the foregoing discussion, numerous alternatives are available for medical facilities in procuring and distributing medical items in ways that are more efficient and reliable, while accurately tracking the use of medications.

As can be appreciated the instructions which cause one or more processors to carry out the methods and operations described herein may reside on computer readable media. Such computer readable media may include for example CD-ROMs, floppy disks, tapes, hard disk drives, memory cards or other media which may be read through operation of one or more computers.

Thus the new system for dispensing and monitoring medical items of the present invention achieves at least one of the above stated objectives, eliminates difficulties encountered in the use of prior systems, solves problems and attains the desirable results described herein.

In the foregoing description certain terms have been used for brevity, clarity and understanding. However, no unnecessary limitations are to be implied therefrom because such terms are for descriptive purposes and are intended to be broadly construed. Moreover, the descriptions and illustrations given are by way of examples and the invention is not limited to the exact details shown or described. In addition, any feature of the invention that is described in the following claims as a means for performing a function shall be construed as encompassing any means known to those having skill in the art to be capable of performing the recited function and shall not be limited to the means disclosed in the foregoing description or any mere equivalent thereof.

Having described the features, discoveries and principles of the invention, the manner in which it is constructed and utilized, and the advantages and useful results obtained, the new and useful structures, devices, elements, arrangements, parts, combinations, systems, equipment, operations, methods and relationships are set forth in the appended claims.